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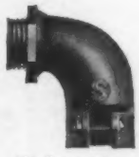

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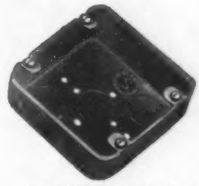

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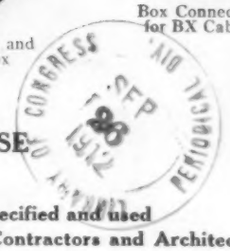

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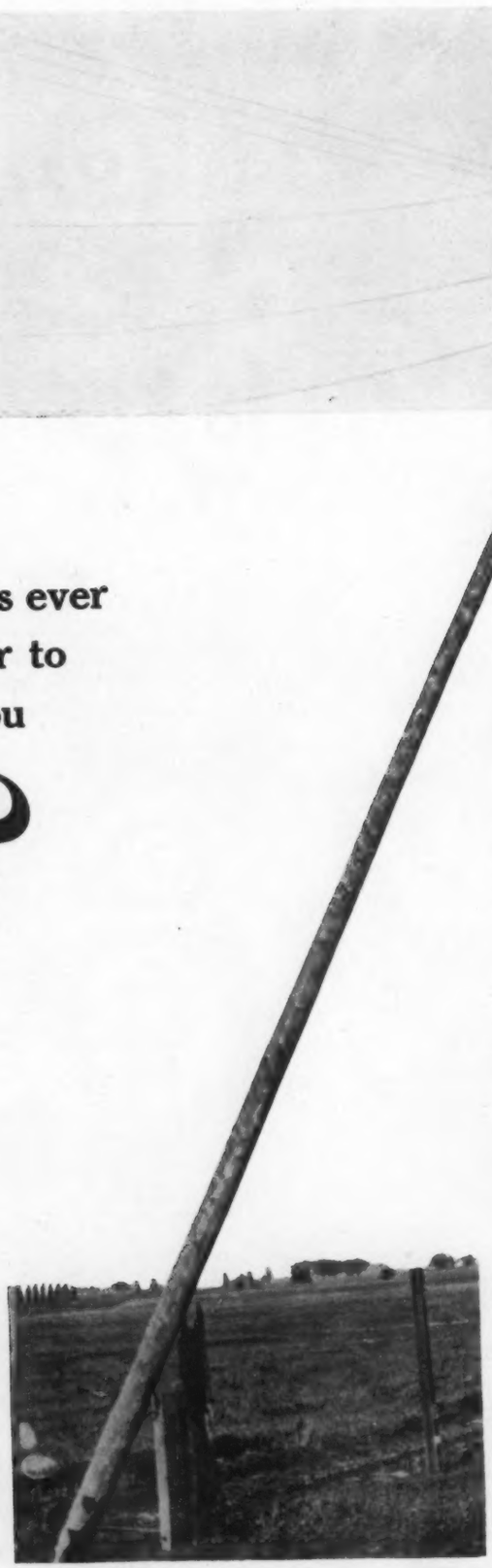

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JOURNAL OF ELECTRICITY
POWER AND GAS
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VOLUME XXIX SAN FRANCISCO, SEPTEMBER 21, 1912 NUMBER 12

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GAS ENGINEERING IN AMERICAN UNIVERSITIES[1]

BY ROBERT SIBLEY.

Introduction.

The rapid rise of California crude petroleum and the high cost of all other kinds of crude gas making materials have made peculiarly favorable the manufacture of oil gas in the Pacific Coast cities. This industry has grown up practically during the past ten years and has given rise to peculiar problems hitherto unencountered in gas manufacture.

As best setting forth some of these peculiar problems, let us review for a minute the titles of some of the subjects which have been under discussion before this body during the past five years. A glance at the Proceedings of the Pacific Coast Gas Association shows that napthalene troubles have not been infrequent and hence there is embodied much discussion in this organization along this line. "A knowledge of the oil gas situation from a gas man's viewpoint," "The prospects for new production of gas making oil and the determination of water in crude petroleum" having been interestingly discussed before this organization indicate that oil and its uses should play a deep factor in a proposed course in gas engineering. Under the heading of "manufacture of oil gas," papers have appeared on "the history of the gas lighting industry," "the study of water and coal gas," "the progress in oil gas manufacture," "the mechanical handling of the carbon by-product of the oil gas process," "napthalene problems in oil gas manufacture,""the chemical control of oil gas manufacture," "oil gas residual and how to handle it," "carbon in oil gas manufacture," "purification problems"—such problems as these give a strong indication of lectures and investigations to be covered in a specialized study of gas engineering on the Pacific Coast. On the other hand, distribution problems play deep and significant roles in the oil gas industry. The gas meter, napthalene problems in distribution, gas leakage, gas distribution in big cities, high pressure systems of distribution, suburban gas distribution, point out the channels to be investigated after the gas is stored in the holder. Upon delivery to the service pipes of the consumer questions of illumination arise such as effective gas lighting, effects of high pressure upon illuminating gas and a proper method of heat measurement for a maximum illuminating efficiency. Modern methods of heating and the introduction of the gas furnace constitute ever-changing problems and

The Hearst Memorial Mining Building, One of the Beautiful New Structures at the University of California.

[1]A paper delivered before the Twentieth Annual Convention of the Pacific Coast Association at San Diego, Sept. 17, 18 and 19, 1912.

the gas engineer must be ready for their complete solution.

Departing now from the purely technical side, we find that the well-rounded gas engineer should have a comprehensive knowledge of accounting, leading him to sketch out and formulate campaigns for new business getting and efficient methods of gas collections after the delivery of the product has been accomplished.

The rapid rise of corporation regulation has indeed placed an additional burden on the gas engineer and to safely pilot his corporation through the strict rules of regulation he must be familiar with the law, with general methods of appraisal and rate-fixing and he should be ready to define at the proper moment a clear and definite public policy for his corporation; such a public policy would necessitate general knowledge of fire insurance and fire protection as applied to gas and electrical business, a general knowledge of legal matters, especially those relating to damage claims that may arise in the prosecution of the industry. Methods of accident prevention and maintaining proper relations with the public should likewise enter into his training. A well-rounded personality in the young gas engineer should be developed so far as possible, thereby making the engineer capable of dealing with municipal affairs and men. In such affairs technical problems of inspection of gas and gas meters under municipal authorities will arise and troubles with dissatisfied consumers must be met. In fact, as nearly as possible a training in human nature seems to be necessary.

Grouping of Universities.

In casting about for a solution of the problems of the most efficient gas engineering course, I have followed largely the well known proverb of George Westinghouse which states that "It is cheaper to buy experience than to manufacture it." With this idea in mind, then, the latest catalogues of some sixty of the leading American universities have been carefully examined and as nearly as possible all data relating to any phase of gas engineering has been jotted down. Information from a few of our leading American universities is lacking, but it is believed that a careful perusal of the data herewith appended will give a strong conception of the present status of gas engineering in our American institutions. It is believed, too, that the compiled information representing a widely diverse territory will give general conclusions which otherwise might be considered sectional in character. To supplement this general catalogue data I have corresponded with interested representatives of five or six of those universities which seem to have devoted considerable attention to gas power engineering and to the manufacture of gas. Among these universities may be mentioned the University of Michigan, the Massachusetts Institute of Technology, Cornell University and the University of Wisconsin. In compiling the information gotten from these sources I have classified the various institutions into four different groups. No fast and hard lines, however, can be drawn and only in a general way can this grouping be considered applicable. Group 1 constitutes the American universities which seem at the present time to approach nearest that of the proposed course in gas engineering for the Pacific Coast. Group 2 includes all universities of America which seem to give a strongly specialized course in chemical engineering and in gas power engineering or allied subjects in mechanical engineering and heat engineering. Group 3 is made up of those universities and colleges which give either gas power engineering or general commercial engineering without special emphasis on gas manufacture. Under Group 4, I have included those institutions which merely give such courses as thermodynamics and simple applications in gas power engineering and general industrial chemistry.

Group 4.

Under Group 4, as noted in the data appended in the addendum, may be found the following institutions and a brief description of courses pertinent to the subject under discussion:

The Colorado Agricultural College seems to give but one course in thermodynamics covering the study of its general principles and is required in the mechanical engineering course.

Washington University, of St. Louis, Mo., maintains a course in industrial and engineering chemistry together with visits to industrial establishments.

At the Iowa State College a study of heat engines, gas engines and producers and gas engine construction and operation is maintained.

Gas and fuel analyses with a study of boilers and producers is maintained at the Syracuse University.

The University of Arkansas has two courses, one on gas engines and producers and the second on power plant operation and equipment which deals partly with gas and oil engines.

The University of Iowa maintains two courses, one the study of gas and fuel analyses and the other a course in industrial analyses covering the testing of petroleum and coal tar products as well as other commercial products.

The Montana State College maintains but a course in thermodynamics.

The University of Oregon has a course in industrial chemistry and another one in commercial engineering dealing with the systematic study of the appliances used in industrial processes.

The Rose Polytechnic Institute maintains a course in gas engines.

The Lewis Institute covers in its course elementary thermodynamics, heat engines and analyses of engine materials which includes coal and gas fuel value determinations.

Lehigh University has a course in elementary thermodynamics followed by a study of gas engines.

Group 3.

Group 3 as noted above constitutes a seemingly more specialized group of courses in universities looking toward gas manufacture, although even in this group the actual manufacture of gas is but slightly touched upon.

The Rose Polytechnic Institute has four courses, one on gas for oil engines, another on elementary thermodynamics, a third on heat engines and a fourth on gas engine design. The laboratory seems to be well adapted to gas power engineering but very little attention is paid to gas manufacture.

Leland Stanford Jr. University maintains courses in industrial chemistry, heat engines and thermodynamics.

The University of California, although considering broadening the work immensely, maintains at the present time but four courses, two in chemical technology, one in thermodynamics and another in heat engines. These courses are, of course, supplemented in the mechanical laboratory.

Purdue University has two courses entitled Gas Engineering which cover the line of study devoted to the underlying principles of the production and utilization of gas. Gas engine design is also the title of a third course found there.

Ohio State University has six courses, three in industrial chemistry, one in industrial inspection, another on gas engines and producers and still another on the underlying principles of thermodynamics.

Harvard University has three courses entitled Gas Analyses, Industrial Chemistry and Elements of Thermodynamics.

The University of Missouri has four courses entitled Industrial Chemistry, Heat Engines and Gas Producers.

The University of Kansas has likewise four courses entitled Chemical Engineering, Gas Analyses, Gas Engine Design and Elementary Thermodynamics.

Lafayette College discusses the elements of chemical engines and chemical technology in their department of Chemistry and elementary thermodynamics and gas engineering in their Mechanical Engineering Department. The latter course consists of a study of producer gas, water gas and illuminating gas.

The Michigan Agricultural College devotes a term to gas power engineering, being the study of internal combustion engines and power gas generation, which is preceded by a study of elementary thermodynamics.

The Case School of Applied Science takes up the study of elementary thermodynamics following it by a course on gas engines and testing in the engineering laboratory. There is also a course on the testing and analyses of industrial materials.

Group 2.

In this group, as noted above, are to be found a number of splendid courses given at some of our American universities on gas power engineering and chemical engineering. In some of them it may be seen that the manufacture of coal gas is considerably dealt with.

The University of Wisconsin with its laboratory of technical fuel gas and oil analyses, its lectures on municipal gas manufacture and distribution, together with its lectures on power and fuel gas manufacture and distribution is closely allied to the ideal we have in mind for our Pacific Coast course. A deep study into thermodynamics and its practical application in gas engineering is prerequisite to the courses at this university as may be found in more detail in the addendum.

The University of Illinois seems to have strong features leaning toward gas manufacture. Here is found actually a course entitled Gas Engineering and under this are discussed such subjects as, chemistry for engineers, technical gas and fuel analyses, the manufacture of gas, the calorimetry of oils, and the combustion and classification of coal. This work is strongly supplemented from the gas power side in their Mechanical Engineering Department where we find courses in heat engineering, thermodynamics, power measurements, and heat motors.

The Massachusetts Institute of Technology likewise presents a strong course closely allied to the subject under discussion. Here a series of courses on the testing of oils, the analyses of gas, heat engineering and internal combustion engines, indicate strongly the leaning toward this direction.

A course in gas power engineering at Cornell University likewise indicates specialization. Here we find courses on gas machinery design, gas manufacture and distribution, and gas power machinery.

The Armour Institute of Technology with its well equipped laboratories covers thoroughly the subject of gas power engineering, dealing with gas engines, gas power plants, calorific values of fuels and a thorough course of industrial chemistry.

The Sheffield Scientific School of Yale University maintains strong courses apropos to our subject among which may be mentioned power plant chemistry, gas calculations, gas analyses, chemistry for engineers, thermodynamics, gas engineering and advanced thermodynamics.

Finally the University of Nebraska completes this group with seven courses dealing with our subject, four of these are on engineering chemistry, one on thermodynamics, another in fuel testing laboratory, and still another on gas power engineering.

Group 1.

From the information that I have been able to gather, I would include but one American university in Group 1, which is the University of Michigan. Even at this university, however, no specific course leading to a degree in gas engineering has ever been announced although for ten years past in connection with their chemical engineering course considerable attention has been devoted to the subject of gas engineering. In 1901, the Michigan Gas Association endowed a fellowship at this University which allows the occupant, who must be a graduate-student, to pursue an additional year at the University in the study of some problem in gas manufacture. This fellowship amounts to $500 per year. During the past year this same association has established a junior scholarship amounting to $300 a year in addition to the former one. It is interesting to follow the splendid work and splendid impetus that the establishment of this gas engineering fellowship has had in promoting interest and research in gas engineering.

Gas Engineering Fellowship at Michigan.

Let us then devote considerable attention to the fruits of this fellowship at Michigan. The information that I have gotten is by correspondence with Alfred H. White, Professor of Chemical Engineering at the University of Michigan, and who I understand has had the direction of the gas engineering research work. The dominant motive of the founders in establishing this fellowship at Michigan was evidently a desire to enrich the gas engineering profession by bringing into it a few chosen men with special training in the profession with the evident hope that public attention would be called to the desirability of gas

engineering as a career and that thus more men would fit themselves for it. A secondary consideration was undoubtedly that valuable research work might be accomplished.

So significant have the results been of this work in Michigan that during the eleven years not only has the Michigan Gas Association maintained this fellowship, but the scope of the research has been enlarged and advanced until today the U. S. Bureau of Mines is undertaking special investigations in conjunction with the research work at Michigan.

Of the first four holders of this fellowship, three were chemists and one a mechanical engineer. During later years, however, the establishment of a chemical engineering course at Michigan has given such an impetus to gas engineering study that all of the students have come from this course. At the start, since no facilities were offered for gas manufacture, the holders of the scholarship, of necessity, had to devote their time to the study of the utilization of gas. It is interesting and remarkable, however, to see how well this work was performed. Herman Russell, the first holder of the scholarship, undertook the study of the Welsbach Mantle. He showed that with commercial burners and gas of commercial grade the illuminating value of a mantle is closely in proportion to its net heating value and almost independent of its candle power. This would substantiate E. C. Jones of our own Pacific Coast Gas Association in his contention of last year that candle power as the important standard for gas should be relegated to the scrap heap. The next holder of this fellowship, A. F. Traver, continued the investigations of Mr. Russell. This latter investigator was by extremely painstaking measurements able to actually measure the mantle temperature as distinct from the flame temperature and to show that the mantle was, contrary to the theory then usually held, not nearly so hot as the flame. European investigators have since confirmed Traver's experiments. Traver also showed that an increase in the temperature of the mantle meant an increase in light and so called attention to the matter of designing burners which would give high temperature as the logical step toward increasing the efficiency of the mantle. The third investigator took up the subject of the determination of mantles while burning and was able to show that the mantles of some manufacturers suffered less in this respect than others did, and hence pointed out the advisability of testing sample mantles, not only after a few hours' use, but also several hundred hours' continuous burning. At the end of the fourth year, the Michigan Gas Association called attention to the naphthalene troubles that were being experienced among its member companies and Samuel Ball, the fourth holder of the fellowship, devoted his time to necessary initial experiments for the deep investigations to be followed by later holders of the fellowship. He redetermined the vapor pressure of naphthalene and showed that it was not abnormally affected by water vapor, ammonia, acetylene and other substances as had been previously claimed by other writers. He also developed a method for the determination of naphthalene in crude gas and small quantities of tar, which although somewhat inaccurate still holds for the particular purpose, and by application of this method was able to show that tar was a much more important factor in the elimination of naphthalene than had been supposed.

The next holder of the fellowship continued these investigations by studying at various gas works, paying particular attention to the behavior of naphthalene during the condensation of coal gas. He obtained concordant results showing that samples of gas drawn from the foul main, condensers, and tar separators, contained very small amounts of naphthalene in the free state, almost all of the naphthalene being in solution in the tar fog present. Samples simultaneously taken beyond the ammonia scrubbers frequently showed decided amounts of naphthalene in the free state, almost all of the naphthalene being in solution in the tar fog present. These experiments were repeated by this investigator and by his successor and a complete confirmation of the theory advanced the preceding year was established. Thus it was established that the ammonia by its solvent action on the phenols of the tar frequently caused the remaining tar to be saturated with naphthalene. The naphthalene thus liberated was that which later caused troubles in the distributing system.

At the end of the sixth year this work assumed in the eyes of the Michigan Gas Association such importance that it was decided to build an experimental gas plant. As first conceived this was to consist of a miniature retort and condensing system at the University. This conception, however, soon gave way to the larger one of the installation and purifying plant capable of handling the gas from one of the regular works retorts to which it could be connected at will. The installation was planned with the advice of expert gas engineers and with the hearty co-operation of various manufacturers of equipment for gas works. So important now became the results gotten from this experimental gas works that we find in the ninth year the Technological Branch of the U. S. Geological Survey, now the U. S. Bureau of Mines, began undertaking work in conjunction with the investigators at Ann Arbor. In the tenth year the two-room building was enlarged to four rooms and the equipment increased and improved. Thus it is seen what splendid results have been accomplished at Michigan.

Undoubtedly one of the most prominent underlying reasons for the founding of this fellowship is to train men for responsible positions for gas manufacture. Let us for a moment see what these eleven men are doing. Ten have remained in gas engineering work and the eleventh is a consulting engineer. The remarkable prominence obtained by these men is fully set forth in the following professional records:

Herman Russell, B. S., University of Michigan, 1898, M. S., ditto. 1901
Holder of fellowship in gas engineering 1900-01
Inspecting engineer Detroit Gas Co 1901-02
Assistant superintendent Detroit Gas Co 1902-03
Supt. gas manufacturing, San Francisco Gas & Electric Co.. 1903-04
Assistant engineer Cincinnati Gas & Electric Co 1904-05
Assistant supt. gas manufacturing, Rochester Ry. & Lt. Co.. 1905-06
Superintendent gas manufacturing, Rochester Ry. & Lt. Co.. 1906 to date

Alva F. Traver, B. S. in Mech. Eng., University of Michigan 1900
Holder of fellowship in gas engineering 1901-02
Draftsman Grand Rapids Gas Light Co 1902
Assistant superintendent Grand Rapids Gas Light Co 1903-05
Superintendent and engineer Grand Rapids Gas Light Co 1905-07
Engineer Chattanooga Gas Co 1907-09
Supt. gas dept., Denver Gas & Electric Co 1909-11
Supt. gas and steam heating dept., Denver Gas & Elec. Co.. 1911 to date

Max E. Mueller, A. B., University of Michigan.....1903
Holder of fellowship in gas engineering.....1902-03
Clerk Ogden Gas Co., Chicago.....1903-04
Chemist New Amsterdam Gas Co., New York City.....1905-06
Asst. supt. Astoria Light & Power Co., Astoria, L. I.....1906-11
(Mr. Mueller put into successful operation the plant for extraction cyanogen at the Astoria Works and described the process in a paper before the American Gas Institute in 1910.)

Samuel Ball, A. B., University of Michigan.....1903
Holder of fellowship in gas engineering.....1903-04
Student Jackson Gas Co.....1904-05
Superintendent La Porte Gas Light Co.....1905
Assistant superintendent Saginaw City Gas Co.....1905-06
Superintendent Bay City Gas Co.....1906-10
General superintendent Saginaw & Bay City Gas Co.....1910-11
Manager Bay City Gas, Power & Street Railway Co.....1911 to date

David H. Clary, B. S. in Chemical Eng., University of Michigan..1904
Holder of fellowship in gas engineering.....1904-05
Apprentice Jackson Gas Co.....1905
Chemist Western Gas Construction Co.....1906-07
Gas expert Western Gas Construction Co.....1907-09
Superintendent of works, Minneapolis Gas Light Co.....1911
Chemist Pittsburgh Coal Co., Minneapolis.....1911 to date

Joel M. Barnes, B. S. in Chemical Eng., University of Michigan..1905
Holder of fellowship in gas engineering.....1905-06
Assistant superintendent Saginaw City Gas Co...June to December, 1906
Production engr. Miller & Franklin Co., Boston.....Dec. '06 to July '09
Manager Miller & Franklin Co., Boston.
Treasurer Hoophone & Barnes Co., production engineers, Boston.....July '09 to July '10
(Mr. Barnes has been one of the pioneers in production gas engineering. He has devoted himself especially to the textile and paper industries and has introduced scientific methods in about twenty large manufacturing companies in New England.)

Fredrick E. Park, B. S., Chemical Eng., University of Michigan...1906
Holder of fellowship in gas engineering.....1906-07
Assistant chemist Detroit City Gas Co.....1907-08
Chief chemist Detroit City Gas Co.....1908-10
Superintendent Station B, Detroit City Gas Co.....1910 to date
(Mr. Park developed a method of identifying gas oils by measuring sp. absorption of bromine, which was described in a paper read before the American Gas Institute in 1909.)

John H. Wyman, B. S. in Chem. Eng., University of Michigan....1907
Holder of fellowship in gas engineering.....1907-08
Assistant superintendent Ann Arbor Gas Co.....1908-10
Assistant superintendent Kankakee Gas Co.....1910-11
Chemist Grand Rapids Gas Co.....1911 to date

William A. Dunkley, B. S. in Chem. Eng., Univ. of Michigan....1908
Holder of fellowship in gas engineering.....1908-09
Cadet engineer Lansing Fuel & Gas Co.....1909-10
Chemist C. H. Geist Co., plant headquarters, Atlantic City, N. J.....1910 to date

Benjamin M. Ferguson, B. S. in Chem. Eng., Purdue University..1909
Holder of fellowship in gas engineering.....1909-10
Asst. chemist and time study man Detroit City Gas Co.....1910 to date
(Mr. Ferguson has recently been devoting most of his time to studies in scientific management. He contributed a paper on this subject at the 1911 meeting of the Mechanical Gas Association.)

Reuben S. Tour, B. S. in Chem. Eng., University of Michigan.....1910
Holder of fellowship in gas engineering.....1910-11
Asst. to supt. Consolidated Gas Co., 21st St. Sta., N. Y.....1911 to date

Rudiments in a Gas Engineering Course.

From the general outline of work entering the field of gas engineering given at the outset in this paper, it is clearly evident that the young engineer to successfully grapple with them should be prepared to solve all those problems which arise in general engineering practice. At the completion of this general engineering course, he should have a working familiarity with organic chemistry, with a special emphasis on coals and crude petroleums. The by-products of coal manufacture with coal tar, ammonia and their handling should be emphasized, and also the investigation of the breaking up of crude petroleum under constant temperatures with special reference to the electric furnace for the treatment of oils under constant temperatures. On the other hand, the mechanical engineering features are strongly requisite for the well-rounded gas engineer. In particular may be mentioned blacksmithing and machine pattern making, together with finished foundry work, strength of materials with emphasis on building design, especially in structural concrete work and brick work. The study of combustion and the losses in distribution in the use of all kinds of gas should be mastered. Mechanical drawing with a knowledge of building design and how to talk with a lead pencil, involving free hand sketching of mechanical objects and piping are also imperative.

Bearing, then, these characteristics in mind, it would seem that the ordinary four-year college course is too little time to give to such a specialized training. The four-year course at the University of California is organized not only to teach the fundamental principles that underly general engineering but also to give practical training and such construction in the economics of engineering as is possible in a technical school. The success of an engineer has come to mean his ability to meet engineers and men of culture on equal terms and since the work in the regular four-year course is almost wholly technical, a fifth year is imperative to gain the finishing work necessary in general culture subjects as well as deep investigation in the specialized matter pertaining to the work under discussion.

A Suggestion for Students of Mechanical Engineering.

At the University of California, the following courses are now given in Mechanical and Electrical Engineering. There is also included a suggestion for a possible combination with the Chemistry Department for such courses as may best prepare students in the department of Mechanical Engineering for a later specialization in Gas Engineering.

COLLEGE OF MECHANICS—FOUR-YEAR COURSES.
Matriculation Requirement, Group II.

I.	Units.	
Subject A	.	.
Math. 3A-3B	3	3
Phys. 1A-1B	3	3
Chem. 1A-1B	3	3
Chem. 3A-3B	2	2
C. E. 1A-1B-1C-1D	3	3
Phys. Cult. 1A-1B	1	1
Hygiene 1	2	.
Mil. 1A-1B	½	1
Mil. 2A	1	.
C. E. 3A (Sum)	(3)	
Elective	.	1
	18½	17

II.	Units.	
Math. 4A-4B	3	3
Phys. 2C-2D	3	3
Draw. 2A-2B	3	3
Mech. 1A-1B	3	3
Mech. Eng. 8A	2	.
Mech. Eng. 106A	.	3
Mil. 1A-1B	½	1
Mil. 2B	1	.
Mechanical		
Mech. Eng. 8B	.	2
Elective	3	.
	18½	18
Electrical		
Mech. Eng. 8B	.	2
Elective	3	.
	18½	18
Gas Engineering		
Chem. 5A-119	3	2
	18½	18

III.	Units.	
Mech. 102A-102B	3	3
or		
Phys. 105A-105B	3	3
C. E. 8A-8B	3	2
Mech. Eng. 106B	2	.
Draw. 105	.	2
Elec. Eng. 110A-110B-110C	2	3
Mechanical		
Mech. Eng. 9A-9B	2	2
Math. 110A-110B	2	2
Elective	4	4
	18	18
Electrical		
Math. 110A-110B	2	2
Phys. 107A-107B	3	3
Mech. Eng. 9A-9B	2	2
Elective	1	1
	18	18
Gas Engineering		
Mech. Eng. 9A-9B	2	2
Chem. 8A-8B	2	2
Chem. 8C	.	2
Elective	4	2
	18	18

IV.	Units.	
Mech. Eng. 104A-104B-104C-104D	3	3
Mech. Eng. 103A-103B	3	3
Mech. Eng. 105A-105B	3	3
Mechanical		
Draw. 107A-107B	2	2
Mech. Eng. 107A-107B-107C-107D	2	2
Elective	3	3
Thesis	2	2
	18	18
Electrical		
Elec. Eng. 111A-111B	4	4
Elec. Eng. 111C-111D	3	3
Thesis	2	2
	18	18
Gas Engineering		
Mech. Eng. 107C-107D	2	2
*Mech. Eng. X	.	3
**Chemistry X	3	.
***Chemistry X_1	3	.
****Mech. Eng. 107E	1	1
Thesis	2	2
	17	17

NOTE:
*Mech. Eng. X—Gas Plant Construction.
**Chemistry X—Chemistry of Gas Manufacture.
***Chemistry X_1—Physical Chemistry.
****Mech. Eng. 107E—Gas Engineering Laboratory (one afternoon per week—new).

It is seen from the above (and we may note in passing that this course is practically the same in the first two years in all the Engineering Colleges at Berkeley) that certain electives are open at the beginning of the sophomore and throughout the junior years. It will be well, then, to fill in these electives by rounding out a knowledge of chemistry. This should consist in thorough courses in quantitative analyses and in organic chemistry.

Complete Outline of Gas Engineering Course.

Taking now into consideration the present status of gas engineering in the American universities—particularly the excellent results of eleven years of experience as brought out in Michigan—and adapting all these ideas to Western conditions and problems, it would seem that the following outline would bring about the best results in preparation for an active life in gas engineering. A student upon entering college should take such a course during his freshman year as would give him a thorough grounding in the elements of mathematical analysis, a comprehensive study of fundamental physics, elementary inorganic chemistry through qualitative analysis and the elements of plain surveying with sufficient ground work to give him an elementary idea of the laying out of distributing mains and the necessary plotting of typographical features encountered. The sophomore year should continue the grounding in mathematical analysis begun in the freshman year and carry the student through differential and integral calculus. Higher physics should be undertaken in order to clinch the ideas begun in the freshman year and, in addition, mechanical drawing, followed by descriptive geometry, should be undertaken in order that the student may learn to talk with the lead pencil when future call may come upon him in the design of gas engineering plants. Shop work, dealing with pattern-making, should also be undertaken. In addition to the foregoing work of the sophomore year, quantitative analysis should also be studied in the Department of Chemistry. In the junior year, having now laid the fundamental basis for technical study, the mathematics of physics, or what is known as engineering mechanics, with its splendid training in mental development should be taken. The shop work begun in the sophomore year should now be supplemented with foundry work and machine shop practice, in order that the many intricate problems met with in power plant design may be practically solved, should future occasion present itself. Indeed a thorough course in machine design should supplement the work in the shop as should a thorough grounding in the study of strength of materials and structural design. Organic chemistry should also be undertaken during this period in order that now, having completed the junior year, the student may get his first insight into real practical gas engineering. At the completion of this year arrangements should be made for those having this thorough ground work to pursue a summer's work in the gas plant of some of the member companies of this association. In this work the student should start, if neccessary, at shoveling lamp black and in fact get as near to the actual process of gas manufacture as may be possible. This three months' grounding will give him a thorough idea of the gas industry and unquestionably the beginning of the senior year will find him more serious and sober than ever before in his mental attitude toward his future profession. Having then successfully passed through the summer's work, the senior year at the University should consist of a thorough grounding in thermodynamics, a study of heat engines and gas engines, a study in elementary gas manufacture and perhaps a thorough course in hydraulics or the flow of liquids in order that future problems in the flow of gases may from analogy be the easier solved. A thesis during this year should be carefully chosen in order that he may try out by experiment some of the problems which unquestionably will suggest themselves to him during his summer's work at the gas plant, undertaken as noted above at the completion of his junior year. Having now obtained his degree (Bachelor of Science) the engineer in embryo should enter again some of the plants of the Pacific Coast Gas Association. This time, however, he should be placed for a summer's work in the laboratory and other instructive branches of the gas manufacturing industry, so that when the opening of college arrives in the fall, no doubt longer should remain as to the significance and opportunity of the life work he has before him. Upon his return to college in the fall, he should devote the year to subjects of general culture and to some specialized investigation along his chosen field.

As to the subject matter to be undertaken in this specialized investigation and as to the equipment required, we may now draw forceful conclusions from the experience of the last eleven years at Michigan above enumerated. It has been seen that in American Universities at the present writing there is little attention paid to specialized coal and water gas manufacture and none whatever to the varying and intricate problems encountered in oil gas production. Indeed, the rapid rise in gas distribution over long distances already presents many problems which hitherto have been solved by rule of the thumb only, but which in the future, due to research of this sort, may be put upon a more rational basis. The experience at Michigan points indelibly to the conclusion that an experimental gas plant is absolutely necessary and that this preferably should be located at a nearby commercial installation. The most striking conclusion presented, however, is that the most lasting and interlinking co-operation between the university offering this course and the gas association contributing thereto is absolutely imperative. From the fruitful results obtained at Michigan it is seen that the training of competent and successful men to enter the profession follows at once in the footsteps of a gas engineering course. Indeed, not only is the association blessed with having highly trained specialists enter the industry but the successful solving of intricate and complicated problems in gas manufacture and distribution is the inevitable result. It would seem, then, that rather than the endowment of a fellowship as has been undertaken at Michigan, it would be better that the money offered by this association go toward equipment or toward the employment of a research instructor to be ever on the alert to point out the path for these research students returning in

their graduate year, rather than waste ammunition in offering fellowships, for a sufficient number will enter the work without encouragement of this sort.

Possible Saturation of Field.

During the past year the University has placed three of its graduates from the Mechanical Engineering Department with the gas department of the Pacific Gas & Electric Company. These young men are today busily engaged in acquiring the rudiments of the art. By the placing of these three men experience has already shown that too soon may the field of gas engineering become saturated unless hearty and wholesome co-operation is extended from every member company of this gas association. The rapid rise of unforseen uses of gas and, also, the increasing importance of the internal combustion engine make the future of gas power engineering exceedingly bright. Hence in view of a possibility of an over-saturation of gas engineers in the manufacture of gas we must not lose sight of the fact that the proposed courses in gas engineering should equally prepare the student to enter the wide and promising field of gas power engineering. Thus will be given pliability and elasticity to the opportunities offered in all phases of gas engineering.

The Question of a Degree.

The question of a degree to be conferred, if at all, is one of many complications. At the present time no university in America confers the degree known as "gas engineer." At the University of California no professional engineering degree is given the student upon graduation from the engineering college, the degree awarded being simply B. S. or Bachelor of Science. Unquestionably the student returning for his fifth year as outlined above should upon its successful completion be awarded the degree of Master of Science in accordance with the regulations now in force at the University. As to whether a further degree should be conferred upon the student after years of practical research and experience, it is difficult to say whether even then the better part of wisdom would indicate that this be done. After all the Biblical quotation "By their fruits shall ye judge them" is the most potent mark in life by which the engineer may be known.

In all of the discussion set forth above it is to be understood that the ideas expressed are only individual and in no sense are to be considered the sentiment of the University Academic Senate or a leaning of sentiment by the Faculty but rather have they been expressed to bring out a thorough and complete discussion here of the different points mentioned.

Environment.

As a final consideration of a gas engineering course or courses, often even more important than considerations of technical and cultural subjects and even research equipment, is that of environment surrounding the student during his undergraduate days. What nobler mission could a university of the West have than that of fitting men for the solution of western, yes, world-wide, problems in gas engineering and how well is she prepared by her environment to fulfill this mission! With her beautiful hills to the east, the Golden Gate to the west, California inspires her sons to go ever onward and upward in the realms of scientific thought and research. Between snowy peaks to the north and burning deserts to the south she has distributed with lavish hands opportunities which it is for her sons to develop. The welfare of the state calls for the welfare of her university and that we should ever seek the welfare of our university is the most lasting lesson that she teaches those of us who have the honor and privilege of calling her our Alma Mater.

Independence in Research.

In the present day development of California two types of men are present, those who have made their all and have come West to live with us in an ideal atmosphere and those of the ambitious, but poor, whose motto is to strive and to work.

The noble motive promoting the gigantic effort shown in the collecting of a substantial fund among the member companies of this association is indeed to be commended in the highest terms. By means of it this insignia "to strive and to work" will be placed one step higher. This association, already emblazoned in the hearts of men, and known by its own motto throughout the length and breadth of our coast cities as ever active and alive—indeed as having no "dead ends," may well be said to be materially aiding in bringing about that time of unhampered individuality in study and research of which Kipling has so forcefully written:

"And only the Master shall praise us,
And only the Master shall blame,
And no one shall work for money,
And no one shall work for fame:
But each for the joy of the working,
And each in his separate star
Shall paint the things as he sees it
For the God of the things as they are."

STATUS OF AGITATION AGAINST CALIFORNIA LAW NO. 499.

Referring to State Law No. 499 it seems to be the opinion of most of the representatives of the power companies that for the present it is better to leave State Law No. 499 alone, and wait until the Railroad Commission has issued General Order No 26, as all believe the best way to handle the situation is to try and get State Law No. 499 repealed at the next meeting of the State Legislature, and have the entire supervision of this work come under the State Railroad Commission, where the work can be handled by the Commission engineers in a practical manner, and the power companies can then at any time appear before them and get rulings on any disputed point which may come up.

COLLEGE COURSES IN LOGGING METHODS.

At the Pacific Loggers' Congress recently held at Tacoma resolutions were passed to petition the State universities of California, Oregon, Washington, Idaho, Montana and British Columbia to provide courses in logging engineering. Committees have been appointed and an active campaign is to be conducted to this end. Geo. M. Cornwall, of the Timberman, at Portland, has originated this movement to provide special technical and scientific training for young men entering the lumbering industry. One of the most important subjects proposed is that of the application of electricity to lumbering.

PRESIDENT'S ADDRESS, PACIFIC GOAST GAS ASSOCIATION.

BY WM. BAURHYTE.

As president of the Pacific Coast Gas Association it is my pleasure to welcome you to our twentieth annual convention. We meet this morning in the extreme southern end of the territory covered by our Association, and for the first time in this beautiful city of San Diego, with its arms stretched out to give first welcome to the mighty ships of commerce that are soon to come from the Atlantic through the great canal to our beloved shore. Whether this be your first visit or not I am sure you cannot but marvel at the progress of this city and the rapidity with which it is coming into the front ranks of the great cities of the Pacific Coast.

The remarkable increase in growth of these great centers of population carries with it the concomitant duty of the gas industry to expand in even a greater ratio in order to not only meet but to anticipate the needs of the community. You gentlemen know how well this demand upon our resources has been met. Not only has the past year in the gas industry been marked by a continuance of the great activities of the preceding years, but by an ever increasing ratio of activity in construction, as well as in developing the most modern methods of manufacture.

Nor has this Association failed to benefit by such growth. Its increase in membership is very gratifying, and I desire to particularly welcome those to whom this is their first attendance in convention. Even more noticeable perhaps than the increase in membership has been the increase in the number of excellent papers tendered your officers, and which for lack of time, they have been unable to accept. To encourage this activity rather than stifle it by our inability of proper recognition, it seems to me that at this time an amendment to the by-laws should be suggested extending the period of meeting so as to allow three full days for the business of the Association and the discussion of the papers presented. Since, however, at this convention we are limited to two days, you are requested to be prompt in attendance and to confine your remarks to the point in order to conserve time and enable the members to derive the maximum benefit.

Mr. Frank W. Leach, Jr., my predecessor in office, in his address at the nineteenth annual convention, referred to Constitutional Amendment No. One, quoting the Act for your benefit. This Act has now been in operation for two years, and has vindicated the claims of the Commission that drew it that it would simplify as well as unify taxation governing utility companies. While some difficulty was experienced at first with local assessors on the question of operative and non-operative properties, necessitating hearings before the State Board of Equalization, this friction in the operation of the new law has been negligible as compared with the experience under the old method, involving as it did long drawn contests before local Boards of Equalization, as well as actions at law in an almost vain effort to secure the same method of assessment for the property of utility companies as was applied to that of individuals.

At one of the meetings of our last session we were honored with the presence of Doctor Benjamin Ide Wheeler, President of the University of California, who discoursed at length upon the benefits to be derived from the establishment of a course of study at that institution leading to the degree of "Gas Engineer." Quite a large sum was subscribed toward the establishment of such chair, the very urgent need of which has been graphically told by our esteemed secretary, Mr. John A. Britton. I might add, however, that during the past two decades our great universities have been vieing with each other in turning out electrical engineers, but few, if any, have devoted any attention to gas engineering beyond that involved in the chemical laboratory. It is hoped that the great opportunity thus presented to us will not be lost through lack of funds.

The matter of holding a gas congress in San Francisco in 1915 was first considered at our convention in 1910, and again at the annual convention in Oakland in 1911, at which latter meeting a committee was appointed with full power to actively take up the matter. In a recent letter to our secretary from the secretary of the American Gas Institute, Mr. Ramsdell states that the Institute is probably in the most favorable position to bring about the ultimate success of such a congress, since the bulk of the associations are in the eastern half of the country, but before proceeding with the matter they desire an expression from our Association as to the feasibility of the plan, since, as he states, the Pacific Coast Gas Association would necessarily have to enter into the arrangement to a considerable extent to insure its success. I trust therefore that you will give earnest attention to the report of that committee to be presented at this meeting, as it will express their views regarding the steps necessary to make this the greatest gathering of gas men ever held.

For your further information I quote from the American Gas Institute News for July, 1912, as follows:

> One of the most important events in the gas history of this country was the Gas Congress held in connection with the Louisiana Purchase International Exposition, June 15 and 16, 1904, at St. Louis, Mo., in which ten gas associations took part.
>
> Although the preparation for the meeting was rather hurried and therefore not as carefully planned as further time would have allowed, yet the results fully demonstrated the value and importance of such a gathering. The unique character of the meeting permitted the associations to see the greater and broader field that could be filled by combined numbers and work, in a clearer way than ever before.
>
> As the tendency in the Gas Association field at the present time is in this direction and as some national event seems necessary to awaken proper interest, would it not be well to begin at once to consider the advisability of holding another congress to embrace all the gas associations, during the Panama-Pacific International Exposition to be held in San Francisco in 1915?
>
> If our membership consider it wise to undertake to accomplish this, steps should be taken promptly to enlist the co-operation of other associations and the arrangement of details to make the movement one of national interest and importance.

Governmental control of public utilities has become an established fact in California. It is unfortunate, however, that the Act vesting the railroad commission with control over public utilities still

permits municipal regulation under certain conditions. Under state control, such as exists in New York, Massachusetts and Wisconsin, better results are obtainable than is possible with local boards, the membership of which very largely represents and is subservient to the dominant public opinion. In many instances such control is vested in those whose very political fortunes are due to agitation against public utilities, and who become partisans of the consumer in rate regulation to the disregard of the equities of the companies involved, thus entirely losing sight of the moral responsibility of their trust, a responsibility comparable to that of a judge. State commissioners, well paid and of long tenure of office, are much farther removed from local prejudices and influences. Their rulings, being printed, become precedents for their own future guidance as well as that of similar bodies in other jurisdictions, as are the decisions of courts of law. The dignity of their position and the realization that their rulings are monuments of national importance for or against their erudition and sense of justice induces the members to give their best thought and judgment to each problem presented. Such a commission more nearly approaches what it should be—a bulwark for the consumer against oppression and extortion and a guarantor to capital of the inviolability of property rights. It is to be hoped that before long a commission with such absolute control throughout this state will be established.

At the meeting held in Los Angeles in 1910 it was stated that natural gas in large quantities had been discovered in the Kern County oil fields. Since that time active work has been going on to render the supply in the fields available, and towards the construction of pipe lines of sufficient capacity to transport the gas to the cities of Southern California for distribution to domestic consumers. The supply is believed by those engaged in this work to be sufficient to last for many years, but it is hoped that this belief will be tempered by the experience with natural gas in other localities, particularly in the state of Indiana, and that the use of this gas will be governed by conservation rather than waste.

One year is a very short time in which to notice any great progress in a single field of activity. In the gas industry the progress during the past year has been along steady and useful lines. It is impracticable for me, however, to enumerate the specific improvements. For these I must refer you to the columns of the various technical journals.

The Experience and Wrinkle Editors have been very industrious, and will present for your consideration matters that will prove of the greatest benefit.

Our particular thanks are due to the Novelty Editor, Mr. R. L. Clarke, of San Diego, for his assistance and co-operation along these lines. I also wish to thank the officers and members of the Association for their cordial co-operation during the year, and also to thank the San Diego Consolidated Gas & Electric Company, through its general manager, Mr. H. H. Jones, who will be our host at the outing next Thursday, for the many courtesies extended while the details of this convention were being arranged.

WELDING OF HIGH PRESSURE PIPE LINES.

BY LEON B. JONES.

Since the transmission of gas under high pressure has come into common use, many have been the dreams of the members of the gas fraternity of a faultless coupling.

Improvements in the manufacture of pipe, and the development of the seamless drawn steel tubing, leave little to be asked in the way of pipe, but, as a chain is no stronger than its weakest link, so is a pipe line no stronger than its weakest joint.

Heretofore, the couplings or joints have been the short lived part of high pressure pipe lines. In practically all the couplings now in use, a compressible elastic gasket is necessary. Rubber has been used in joints of most of the pipe lines in California, but as the short time in which rubber loses its elasticity is greatly decreased by the rotting effect of the compression liquids of the gas, the life of rubber gasket joints is very much less than the life of the pipe.

Pipe lines have been abandoned or removed, because the elasticity of the rubber in the joints was gone, and every coupling was a leak, and still the pipe, if undisturbed, would have had a considerable life. In some cases, the gaskets were removed after several years, and the pipe was still in good condition. Up to the present time, the life of high pressure pipe lines laid in the average soil, has been the life of the joint.

With the recent developments in oxy-acetylene welding, a new era has been reached in the transmission of gas under high pressure. It is now possible to lay a pipe line without couplings of any sort. A steel-to-steel tube in which the joining of the lengths is of the same material as the pipe.

Welding with the oxy-acetylene torch has been successfully done in the large shops for several years, but the recent installation of an 8 in. high pressure line in San Francisco is unique in the adoption of this process to the welding of high pressure gas mains.

The oxy-acetylene torch develops a flame temperature which may conservatively be estimated at 6000 degrees Fahrenheit, and it may readily be seen that with this temperature concentrated in a small pencil flame, under perfect control, that all the metals become amenable to the will of the operator.

The welding of iron, steel, copper or brass is accomplished with greater ease and rapidity than the soldering of tin. When this powerful little flame impinges on steel, the metal becoms molten in a few seconds.

The recent installation of approximately 5000 feet of 8 in. steel tubing in San Francisco, in which the oxy-acetylene welding was used on every joint, was laid under the most difficult conditions, and afforded an excellent opportunity for practically testing the adaptability of welding, to high pressure gas mains. This line was laid in Geary street at the same time the municipal railroad was under construction, and this, necessarily, caused many obstructions and difficulties, but in every case, the oxy-acetylene welding proved itself equal to the occasion, and all difficulties were surmounted.

There are three separate methods in which pipe

may be handled when welding with the oxy-acetylene torch.

Bell holes may be dug as for any coupling, and the pipe welded in the ditch, or the pipe may be lowered into the ditch and turned while the welds are being made, thus the welding of many of the joints is done on the top of the pipe, and the necessity for digging large bell holes at every joint is avoided.

The third method, which was found to be the most practicable, where conditions will allow, is to put short pieces of timber across the top of the ditch at intervals and roll the pipe into places directly over the ditch. This method insures a good alignment of the joint, and requires the least labor. With this method, two men can turn as much as 500 feet of pipe, while the operator is welding the joints, and as 500 feet is about as long as can be conveniently handled, it will thus only require a bell hole and a weld in the ditch every 500 feet.

Welding on Top—Pipe Turned in Ditch.

While it is possible to make a good weld without turning the pipe, a great deal more time and care are necessary than when the pipe is turned, and the welding is always done on the top of the joint. In welding the under side of a joint in the ditch it is not possible to pile up the metal, as when welding is done on top of the joint. A joint being welded in the ditch is also more often allowed to cool before the weld is completed, and this leaves a possibility of pin holes where the weld is commenced again.

To insure against the possibility of the weld not extending through the entire thickness of the pipe, the ends of the lengths to be welded were left about ⅛ in. apart, and the operator worked with a rod of 3/16 in. Norway iron in his left hand. This iron is melted into the joint to take care of the gap, and also to build up the metal around the joint. In this way the ends of the pipe are perfectly welded, and the metal at the joint is thicker than in the pipe, thus making the joint the strongest part of the line.

Pipe Being Fed Into Ditch as Each Length Is Welded.

To prove this statement that the weld is as strong, if not stronger, than the rest of the pipe, sample welds were made, and the pipe was afterwards flattened and bent until it was broken. In every case the break occurred back of the weld in the pipe and not across the joint.

A more practical test, which will appeal to gas men, was also made as follows:

Two 40 ft. lengths were supported on timbers laid across the ditch, and the ends welded together. All the supports were then removed from under one of the lengths, and the entire weight of this 40 ft. length was suspended on the joint. The weld was in no way affected by this severe treatment.

Welding Underneath Pipe.

After several hundred feet of pipe are welded into a section, the supports are removed one at a time, and the pipe reeled into the ditch like so much cable. Careful handling is no longer necessary as a weld, if properly made, will stand the same treatment

as the pipe, and any defect is better detected before the pipe is covered.

It may be readily seen that when welding the pipe on top of the ditch, into sections several hundred feet long it is possible to work several welding outfits at the same time, with the minimum of labor. If a little care is exercised in distributing the pipe along the ditch, two men can readily roll it into place, over the ditch, for welding. In many cases, after these sections were reeled into the ditch, the ends of the sections were several feet apart. To avoid using a short piece of pipe and making two welds, a block and tackle was used, and with an automobile for a motive power, these sections, in some cases, 500 feet long, were dragged several feet in the ditch to meet the end of the next section.

As the tubing which was used on this line was approximately 3/16 of an inch thick, and would not permit of threading, the question arose as to how valves or governors should be connected. This was solved in a very simple manner. A short piece of 8 in. standard pipe was threaded onto a standard flange. The standard pipe, which was 8 in. inside diameter, was then slipped over the tubing which was 8 in. outside diameter. After the valve or governor was installed, and the flanges bolted up, the end of the standard pipe was welded to the tubing.

This installation, which represented about 180 joints, was welded throughout its entire length. At the end of each day's work, the line was tested to 150 pounds pressure, and allowed to stand over night. As an extra precaution the joints were also gone over with soapsuds. After completion the entire line was tested to 150 pounds pressure. The line stood at this pressure for three days without loss.

The success of oxy-acetylene welding in the field of high pressure gas distribution depends largely upon the cost of operation, and its ability to meet the general conditions existing in high pressure work. Such an apparatus to meet the requirements of the present day gasman must be economical, reliable and safe.

Cheap electricity has made possible the use of the electric furnace for commercial products and calcium carbide of excellent quality is now obtainable at a very reasonable price.

There are two general methods in which calcium carbide and water may be brought together for the purpose of generating acetylene gas. "Water to Carbide," or "Carbide to Water." Generators may, therefore, be classed as water feed or carbide feed, In the early stages of the development of acetylene, most of the generators were of the water to carbide, or water feed type. This was due to the fact that it was far easier to regulate the flow of liquids than of solids.

However, practice has proven the carbide feed type to be the safest and also to produce the purest acetylene. In this type the carbide is fed into an excess of water, and therefore, the temperature of the generators cannot exceed the boiling point of water and the acetylene, in bubbling up through the lime water formed in the generator, is freed from most of its impurities.

The heat produced from one pound of calcium carbide and the slacking of the calcium oxide formed, is sufficient to raise four pounds of water from the freezing point to the boiling point. It is, therefore, essential that the water in an acetylene generator shall always be in excess.

If a few general precautions are taken there need be no danger in the production of acetylene.

But the compression of acetylene is another story. One of the dreams of the early acetylene industry was that this gas might be safely compressed into a liquid form for convenient transportation and storage. This would appear to be an ideal condition as acetylene liquefies at the comparatively low pressure of 700 pounds per square inch, and a cubic foot of liquid acetylene represents 400 cubic feet of gas. This liquid is only four-tenths as heavy as water.

It must be remembered that acetylene gas is an endothermic compound. In its formation heat is absorbed and that spontaneous decomposition will take place liberating this heat if subjected to abnormal temperature or pressure.

Many violent explosions have occurred due to liquefied acetylene, and now acetylene compressed in open containers to a pressure exceeding two atmospheres (3 lb.) is considered a very dangerous material.

However, calcium carbide represents a more condensed form of acetylene for transportation than the liquefied gas. A cubic foot of carbide represents about 500 cubic feet of available gas, while a cubic foot of liquefied acetylene represents only 400 cubic feet of gas.

Recent developments have also provided a substitute for liquid acetylene in what is known as dissolved acetylene.

While acetylene is soluble in its own volume of water, its very great solubility in acetone has broadened the field of the uses of acetylene many fold. Acetone will dissolve 24 times its volume of acetylene at atmospheric pressure, and for each additional atmosphere to which it is subjected, a similar quantity will be dissolved, in other words, the solubility increases directly with the increase in pressure.

Dissolved acetylene makes possible hundreds of uses of acetylene and the oxy-acetylene blow pipe, which would have been impossible before its discovery.

With the use of dissolved acetylene and oxygen under pressure, a complete oxy-acetylene welding outfit is very readily portable and ready for instant use and can be used in many places where a generator would be impracticable or impossible. When acetylene is dissolved in acetone it seems to be devoid of all possibility of an endothermic explosion under pressure. But the bulk of acetone is greatly expanded by this great absorption of acetylene and it will readily be seen that any container used for acetone for the dissolving of acetylene must be in capacity equal to the acetone expanded.

As the acetylene was used from such a container and the acetone contracted to its normal bulk, open spaces would be left above the liquid in which free or undissolved acetylene would exist, and thus create

danger from explosion. This is overcome by the use of a porous solid which is inert to the acetone and also to the acetylene.

Asbestos is adaptable for this purpose and as it is from 75 per cent to 80 per cent porous the tanks can be packed to exclude all possibility of open spaces for free or undissolved acetylene, and yet leave the greater part of its capacity for acetone and dissolved acetylene.

Calcium carbide can now be obtained at five cents per pound, and as a pound of carbide will produce five cubic feet of acetylene, the cost of acetylene will be one cent per cubic foot at the generator. With an additional cost for compression if it is desired to use dissolved acetylene from tanks under pressure.

Until the introduction of the autogenous or oxy-acetylene welding practically all of the oxygen used in the United States was used for medical purposes and consequently exorbitant prices were obtainable. But since the entrance of oxygen into the commercial field many fertile minds have been busy with the problem of its economical production. Probably the most widely known method is from the reaction of certain chemicals. Oxygen is easily obtained by heating chlorate of potash or chlorate of soda, but as the reactions take place violently with the resultant release of all the oxygen at once, the reaction is impeded by the addition of one-quarter part of black dioxide of manganese. With the addition of the manganese dioxide, the oxygen is given off continuously until the reaction is complete.

Another method is the use of chloride of lime and copper sulphate with the addition of iron sulphate as a catalyzer.

But as the use of chemicals for the production of oxygen is not feasible on a large scale and the economy limited by the price of the chemicals, other methods must be resorted to.

Oxygen may be very cheaply produced by the liquefication and distillation of air. The air is liquefied by high pressure and low temperature and the oxygen and nitrogen separated by distillation due to their difference in boiling points. This is probably the most economical method of producing oxygen as there is an unlimited market for the residual nitrogen as a fertilizer. This method requires an extensive and expensive outlay for equipment and the market for oxygen has not, as yet, warranted the installation of such a plant in the United States, although oxygen has been produced in large quantities in this way in Europe for several years.

Another method which is probably the most promising of cheap oxygen in the near future is the electrolysis of water or the dissociation of water by the use of electricity. The cost of production of electrolytic oxygen is directly dependent upon the cost of electric energy. The cost of equipment for this method of production is not prohibitive and with the prevailing low prices of electricity, oxygen should be obtainable in the near future at a cost not to exceed two and one-half cents per cubic foot.

Acetylene gas of all the hydro-carbon gases most nearly approaches pure carbon. It is over 92 per cent carbon and has a heating value of 1685 B.t.u. per cu. ft. and this partly explains the remarkable temperature attained with the oxy-acetylene blow pipe.

Acetylene requires for complete combustion 12½ times its volume of air or 2½ times its volume of pure oxygen. If complete combustion were attained by burning acetylene with 2½ times its volume of oxygen the products of combustion would be carbonic acid and water.

However, it has been practically proven that the best welding results are obtained by the use of slightly over 1¼ volumes of oxygen to one volume of acetylene and with this incomplete combustion the products of combustion change and instead of carbonic acid and water being formed carbon monoxide and hydrogen are formed. To this formation of hydrogen, which surrounds and envelopes the point of welding, is attributed the credit for the fact that the oxy-acetylene unlike many of the methods of welding has no injurious effect on the metal.

From the foregoing it will be seen that the cost of the oxygen for the oxy-acetylene torch is materially less than would be calculated. The torch used for oxy-acetylene welding is constructed upon the injector principle in which the oxygen and acetylene are conveyed through separate tubes to within an inch of the point of combustion. The acetylene is usually conveyed direct from the generator through hose connections to the torch at a pressure between 3 and 5 lb. per sq. in. The oxygen is stored in tanks and is used through a reducing valve and hose connections to the torch at between 15 and 20 lb. per sq. in. On the handle of the torch are controlling valves whereby a nicer regulation is attained. For lighting the torch the acetylene is first turned on full and lighted. Oxygen is then added until the flame becomes a single cone. An excess of acetylene produces two cones and a white color while an excess of oxygen produces a violet tint.

The hourly consumption of the torch used for 8 in. steel tubing was 24 cu. ft. of acetylene and 30 cu. ft. of oxygen. Using acetylene direct from the generator at a cost of 1c per cu. ft. and oxygen from tanks at 6c per cu. ft. at which price it is now available in San Francisco, the cost of operating the torch would be $2.04 per hour and allowing 40c per hour for the labor of an operator, the total cost of operation would be $2.44 per hour. As the average time necessary to weld a joint on top of the ditch where the welding is done on top of the pipe is ten minutes, the cost of such welds would be slightly over 40c per joint. The time necessary to weld a joint in the ditch where the operator was forced to weld underneath the pipe was 28 minutes per joint, making the cost of these joints $1.13 per joint. But if the pipe is welded into long sections on the ground it is only necessary to have a weld in the ditch to every ten joints welded on the ground. This would make an average cost of 49c per joint. This would be approximately 2c per inch of circumference on steel tubing 3/16 of an inch thick and from this can be estimated the cost of welding various sizes and thicknesses of pipe as the time per weld and consumption of oxygen and acetylene will increase in proportion to the size and weight of the pipe.

MEETING NOTICES.

J. D. Galloway will speak on Hydroelectric Development in California at the meeting of the San Francisco Section of the American Institute of Electrical Engineers at 8 p. m., September 27, 1912. The meeting will be held in the Pacific Telephone & Telegraph Company's building on New Montgomery and Jessie streets, and will be preceded by a table d'hote dinner at Jules Cafe, Monadnock Building, at 6:15 p. m. At this meeting Henry A. Lardner, vice-president on Pacific Coast relations of the committee on organization of the International Electrical Congress, will make a brief report. This report will be made for the purpose of familiarizing the members of the committee on organization, living in San Francisco and vicinity, and also the general Institute membership, as to the progress which has been made by the committee on organization, and specifically on such matters as have been arranged locally with the Exposition authorities. It is also proposed at this time to effect some permanent organization of the Pacific Coast members of the committee, to the end that the assistance and suggestions of the membership may be received, and that all committeemen may have an opportunity to assist in this important matter.

In accordance with the decision of the Joint Committee of Oregon Society of Engineers, American Institute of Architects, American Society Civil Engineers, American Institute Electrical Engineers, and National Electric Light Association, a luncheon was held at the Imperial Hotel at 12:15 p. m. on Tuesday, the 17th. This date and place is tentatively arranged, but it is proposed to make the weekly luncheon a permanent feature, date and place to be arranged later on. This luncheon is intended to provide an informal meeting place for engineers and architects of all organizations, and it is hoped that as many as possible will be present at all future luncheons.

The Seattle Section of the American Institute of Electrical Engineers will hold the opening meeting of the season and annual dinner in the banquet room at the Rathskeller on Saturday, September 21st. The executive committee and other officers and interested members have formulated a new plan of holding the meetings during the coming winter, which it is believed, will greatly increase their value. It is planned to divide the entire section membership into seven groups and have each group furnish a paper and conduct one meeting. The meetings and papers committee will co-operate with each group in the preparation of the papers and program of its meeting.

The affairs of this section are in excellent shape, and the outlook for profitable work during the coming year is better than for any previous year in our history. The time has arrived when there is serious work ahead for this section, and every member should feel that a portion of the responsibility for having this work well done rests on him.

IN MEMORIAM.

James Dix Schuyler, a civil engineer of international repute, whose works are known around the world, died on September 14 at his home in Ocean Park, near Los Angeles, as a direct result of the great fire there ten days ago. Schuyler had been confined to his beach home for several weeks, but his condition had improved so that he would soon have been out. When the flames threatened his residence he was compelled to suffer the excitement of hasty removal, and from that time he failed rapidly. Schuyler was 64 years of age, and had lived in California forty years. He was a consulting engineer, one of a Panama-canal board of seven, was an assistant State engineer, and had ranked as a foremost California builder. He belonged to all the principal clubs here and many American and foreign technical and scientific organizations. Notable among the engineering problems that he worked out in California was that by which the Great Western Power Company of Northern California succeeded in furnishing light and power to San Francisco and other Northern California cities.

James H. Wise.

James H. Wise, assistant general manager of the Pacific Gas & Electric Company, died at Oakland, California, on Sepember 16, as a result of burns received near Bakersfield, California on the preceding evening.

He died, as he had always lived, in the path of duty. Late in the previous week he had left San Francisco in company with P. M. Downing, engineer of maintenance and operation for the Pacific Gas & Electric Company, to make an automobile inspection of the Los Angeles aqueduct to get information to be applied in the construction of the great hydroelectric development at the Spalding dam. Shortly after leaving Bakersfield it was found that the gasoline tank was leaking and a stop was made for repairs at Caliente. While Mr. Wise was emptying the tank the gasoline was accidentally ignited from a torch used to heat the soldering iron and the fire was communicated to his clothing. Mr. Downing quickly extinguished the flames, but not until Mr. Wise had been fatally burned. He was at once brought to the Merritt hospital in Oakland, where hopes for his recovery were entertained for a time, but the severeness of the burns finally caused his death in the afternoon.

Mr. Wise was 33 years of age, and a resident of Alameda during his youth. Graduating from the Alameda High School he entered the University of California and graduated with honors in 1903 from the department of mining. After teaching mathematics for a year at the California School of Mechanical Arts he entered the employ of the Pacific Gas & Electric Company in 1904. Serving first as instrument man and later in charge of field work, he was soon made assistant to Frank G. Baum, being promoted to the position of hydraulic and civil engineer when Mr. Baum resigned. Early in 1910 he joined the firm of F. G. Baum & Company, also being retained as consulting engineer for the Pacific Gas & Electric Company. During this period he was intimately connected with the development of several of the great hydroelectric projects of the West and in July, 1911, was appointed assistant general manager of the Pacific Gas & Electric Company, having entire charge of the construction and extension of the new steam and hydroelectric plants which the company is installing.

A man of the noblest ideals, an indefatigable worker and of a most happy disposition, he was beloved and respected by thousands of friends and associates who prized his acquaintance as a most precious possession. Notwithstanding the commanding position which his merit had won he was ever courteous and affable to all. His untimely death has taken from our midst an engineer and an executive whose life work was but begun, whose example forms an eternal inspiration and whose memory will be fondly cherished in the hearts of all.

He is survived by his mother for whom he had built a beautiful home in Berkeley. The funeral was conducted under the auspices of the Berkeley lodge of Masons from his home in Berkeley on September 19.

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POWER AND GAS

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Steam Constants

The use of orchard heaters, evaporators, and frost protectors of various forms, is each year becoming more prevalent in the agricultural districts of the West. Indeed the timely service of these devices saved millions in crops last winter. In order to intelligently and efficiently operate such apparatus many constants of the steam tables must of necessity enter into the computations involved. Professor Alexander McAdie of the Weather Bureau contributes elsewhere in these columns on this important subject.

The most casual review of the fundamental definitions entering into heat computations brings to light an unwholesome lack of uniformity among the framers of our modern steam tables. For instance one authority defines the British thermal unit or B.t.u. as being the quantity of heat required to raise the temperature of pure water at maximum density, 39.1 degrees F., one degree in temperature. Professor Peabody in his revised steam tables states that one B.t.u. is the amount of heat required to raise a similar quantity of water from 62 degrees to 63 degrees F. On the other hand, Marks & Davis in their excellent recent revision of the steam tables have used a unit based upon the one hundred and eightieth part of the heat required to raise a pound of water from freezing point to boiling point or from 32 degrees F. to 212 degrees F. Such a mean B.t.u. is greater than the Peabody B.t.u. and consequently due to this and other reasons a different value for the mechanical equivalent of heat has been used by these authors. Thus, Peabody states that 1 B.t.u. is equivalent to 778 ft. lb. of energy, while Marks & Davis, after a series of delicate weighings of the investigations of many noted scientists, come to the conclusion that their unit B.t.u. is equivalent to 777.5 ft. lb. of energy.

As a matter of ordinary practical importance any one of the above definitions will lead to reasonably accurate results. Still, in modern refined engineering and scientific experiments we should have standard units of measurement adopted by the great engineering societies which should forever put at rest the confusing and varying constants and definitions wandering through the technical and scientific press of the day.

Secretary Fisher's Proposals on Power Appropriations

The latent power of falling water, like the widow's cruse of oil of biblical fame, may be used over and over again, yet from day to day "it diminisheth not." On the other hand, the great natural resources of coal, oil and timber disappear for ever at an almost inconceivably accelerated rate, if wise and far-seeing constructive statesmanship did not prevent. The transmission of electrical energy over distances now reaching the three hundred mile mark has made possible the utilization of hitherto unharnessed powers for the driving of the wheels of industry in concentrated business centers miles from the mountain torrents, whence comes this pulsating energy.

As over 50 per cent of the possible water power

of the United States is situated in states of the Western slope of the Rocky Mountains and as yet only 7 per cent of this power is actually developed as opposed to 36 per cent of Eastern possibilities already harnessed, the question of future power development is indeed a Western problem and one in which citizens of the West are most vitally interested.

From the best source of information we have at hand, it appears that Secretary Fisher proposes to allow future appropriations of power to be sanctioned subject to severe principal provisions which may be briefly summarized as follows:

1. Free permits to issue for the development of water power for municipal purposes and for irrigation.

2. Similar permits to power companies to issue but with rental charges under a definite schedule.

3. Right is retained to readjust these rental charges at the end of each ten-year period.

4. The power companies must submit to regulation of prices and service by authorities of the state in which the power is sold.

5. The power companies are required to surrender their permit on demand of the United States or to transfer to the state or municipality designated by the secretary at any time, but full value of plant and property is to be paid plus a bonus of ¾ of 1 per cent for every year remaining before time of expiration of permit arrives. Thus, if twelve years remain, a bonus of 9 per cent is to be paid.

6. All permits are to expire at the end of 50 years.

The first provision is unquestionably correct and proper, and the second should be likened with it. Power companies have been called into life to fulfill a definite mission. The enormous capital required can only be secured by assurances of a reasonable profit from the undertaking. Hence, this extra tax simply means an extra charge on the consumer or else it places the power company at a disadvantage in operating in competition to muncipally owned projects. Individual initiative is thus blasted. Laws for promoting conservation should secure the people against the loss of their water power, and at the same time should protect capital and enterprise.

Since the second provision is unjust, it follows that the third only creates a still greater hardship for the power company of the future, making still more uncertain the chances of computing ahead of time the returns to be expected from the investment.

The fourth provision is wise and certainly in the great state of California the newly enacted Public Utilities Act is working out in a satisfactory manner many of the hitherto unreconcilable issues between the consumer and the utility company and at the same time security for the investor is attained. The provision, however, should go one step further and state that in case the municipally operated project engages in a general sales business, it too, should submit to regulation by the state authorities. Already, for instance, the war clouds are appearing upon the horizon in Southern California. Here the Los Angeles Aqueduct proposes to furnish water and light to neighboring cities and towns and yet some enthusiasts of this project desire to charge all the traffic will bear instead of the reasonably regulated rates with which other public utility enterprise that are privately owned must comply.

In regard to provision number five, the plan as suggested seems reasonable and in accord with the latest ideas of public utility evolution. Here, too, the municipality should be put also under the same clause. The time is coming and not very far distant when the larger and more scientifically operated unit —state-wide ownership—will become a proper basis for advancing the economic value of publicly operated hydroelectric networks. Under such a scheme the municipality must with the privately owned enterprise give way to state-wide control and perhaps ownership. Hence the necessity for this provision. It is doubtful whether the particular bonus offered is fair and adequate. Some enterprises offer more hazard than others. The appraised price of purchase should be determined by a commission such as the Railroad Commission of California and should include a physical valuation of so much of the utility works as are used and useful in the business of the utility. This appraisal should allow for a reasonable promotion expense and should include capitalization of interest charges during construction. No value for the franchise or license should be allowed and capitalization of deferred earnings should not be included as the bonus system inaugurated under the clause should amply satisfy the want.

In the sixth provision, a time limit is set for an ultimate expiration of the franchise. A power enterprise is either a necessity in a community or else during later years retrogression has caused its usefulness to cease. If the power—so long as the enterpise is publicly regulated as to service and rates as set forth in provision four—no valid reason exists for making an arbitary termination at the end of fifty years, especially since provision five states that the utility may be publicly taken over at any time. On the other hand, if retrogression has taken place in the community, the enterprise will die naturally without official execution on the part of the Secretary of the Interior. In a word the socalled "indeterminate franchise" of the Wisconsin laws, which is today fulfilling so efficiently the exigencies of power development is what is needed generally instead of the arbitrarily fixed period of use.

It is to be hoped that the authorities at Washington will still further review the subject at issue in the hopes that Western needs may the better be met.

PERSONALS.

Jesse W. Churchill, president of the California-Oregon Power Company, is at San Francisco from Yreka.

H. A. Lardner, manager of J. G. White & Co.'s San Francisco office, is making an inspection tour of Southern California.

F. E. Vickers, Pacific Coast inspector of turbines for the General Electric Company, is visiting the works at Schenectady, N. Y.

H. V. Carter, president of the Pacific States Electric Company, is making an extensive business trip throughout the Northwest.

C. O. Poole, of the firm of Manifold & Poole, engineers for the Southern Sierras Power Company, has been visiting San Francisco.

Fred L. Webster, Pacific Coast manager for the Allis-Chalmers Company, is on his way to the factory at Milwaukee for a two weeks' visit.

C. W. Abbott, engineer for the National Metal Molding Company, is making a trip through California. This week he addressed the Jovian lunch club of San Francisco.

George G. Moore of Detroit is at San Francisco with two friends who are en route to Northern Canada in search of big game. Moore has large electric traction interests in Atlanta, Ga., and Mobile, Ala.

Leslie Hawken, who is connected with the Telephone-Electric Equipment Company, in charge of the Simplex line of healing apparatus, manufactured by the Simplex Electric Company, is making a business tour through California.

Douglas J. W. Metcalf, formerly an electrical contractor at Seattle, has been appointed assistant superintendent of the Calgary Light & Power Company, and will make his headquarters at the generating station, Kananaskas, Alta.

J. McA. Duncan, formerly assistant manager of the Westinghouse Electric & Manufacturing Company's works at East Pittsburg, has been appointed district manager at Pittsburg. He succeeds W. F. Fowler, who has joined the W. S. Kuhn force.

George G. Devore, local manager at Georgetown, Cal., for the Truckee River General Electric Company, Loon Lake district, spent the past week at San Francisco, making his headquarters with the Stone & Webster Construction Company.

J. B. Black, formerly in the general sales force of the Great Western Power Company, has been promoted to power salesman of the San Francisco division. Mr. Black graduated from the College of Mechanics of the University of California only last May.

John A. Britton, general manager of the Pacific Gas & Electric Company, recently gave a most interesting public stereopticon lecture at the McDonough Theatre, Oakland, on the construction work of the company now under way at Lake Spalding.

Alexander Christie, assistant professor of mechanical engineering at the University of Wisconsin, was a recent interested visitor at the University of California, Berkeley. Mr. Christie is just returning from Western Canada, where he has had in charge the installation of a large steam turbine.

Hugh McPhee, a commercial superintendent of the Western Union Telegraph Company, with headquarters at Los Angeles, spent several days at San Francisco during the past week attending a conference of telegraph heads of departments, including Messrs. Dodge and Mays.

E. G. Williams, chief construction engineer of J. G. White & Co., of New York, returned during the week from an inspection of the work in progress for the Mt. Hood Railway, Light & Power Company in Oregon, and he is now looking over the route of the Oakland, Antioch & Eastern Railway through the Sacramento Valley.

J. P. Ault, who is connected with the Carnegie magnetic survey, left during the week for Tahiti to relieve W. J. Peters, who is now in charge of the investigation. In 1905 the work of making a new chart for navigators was commenced off San Francisco on the steamer Galilee. The "Carnegie," the vessel now employed on the survey, is absolutely non-magnetic.

G. E. Prendergast, chief engineer of the Pacific Navigation Company's turbiner Harvard, has tendered his resignation, effective in October, in order to accept the position of superintendent and supervising engineer of the new Standard Oil Building on the corner of Bush and Sansome streets. He is one of the youngest marine chiefs on the Pacific Coast.

Sidney Sprout, consulting engineer for the California-Oregon Power Company, has returned to San Francisco after visiting the new power site on the lower Klamath River. The working force on the big dam at Ward's Canyon has been temporarily reduced on account of delays in the arrival of some of the material. However, work will be presecuted continuously and the plant may be completed next spring instead of in December of this year.

TRADE NOTE

Hunt, Mirk & Company are installing at Los Angeles an additional 5,000-kw. Westinghouse Parsons turbo-generator for the Los Angeles Aqueduct. C. W. Baker, the district erecting engineer, is in charge of the work.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

On September 7th a general order was issued for all public utilities to file such rates as depart from the standard schedule occasioned by such matters as contracts for right of way, etc., employees, charitable uses, educational purposes, etc.

On September 10th, the Central California Gas Company made application to issue $32,000 in bonds and $19,200 in stock to build a transmission line from Exeter to Visalia, Tulare County, and for additions to the gas plant at Visalia and the distributing stations in Visalia and Tulare.

On September 11th, the Commission rendered a decision granting to the Santa Barbara Gas and Electric Company permission to sell $5000 of bonds. The Pacific Electric Railroad Company of Los Angeles applied to the Railroad Commission for blanket authority to issue bonds in the sum of $79,161,000 for refunding and new construction. The Arrowhead Reservoir and Power Company of San Bernardino County applied to the Commission for permission to issue bonds in the sum of $4,000,000 to complete its water system.

On September 12th, the Big Four Electric Railroad Company of Tulare County was given permission to sell 100,000 shares of its capital stock of the par value of $100,000, for the purpose of building an electric railway in Tulare County, 34 miles in length. The company is required to raise from stock $50,000 before prosecuting construction work. Announcement was made that the Commission had in preparation a general order requiring all public utility corporations to preserve all records. The Willitts Water and Power Company filed a reply to the complaint of the town of Willitts, denying unreasonable practices and excessive rates.

On September 13th, the Great Western Power Company filed its answer to the complaint of the Pacific Telephone and Telegraph Company which had alleged interference by induction with its lines between Napa and Vallejo. The Great Western Power Company denies the induction charge. The Pasadena Lake, Vineyard, Land and Water Company and the North Pasadena Land and Water Company filed an application, in which the city of Pasadena joined, to sell their respective water plants to the city of Pasadena; the Pasadena Lake, Vineyard, Land and Water Company for $621,622.31 and the North Pasadena Land and Water Company for $194,217.83. The city of Pasadena recently voted bonds for a water plant of $1,250,000. Hearing was held upon application of the Pacific Gas and Electric Company to sell general and refunding mortgage bonds in the sum of $5,000,000.

N. W. ELECTRIC LIGHT AND POWER ASSOCIATION CONVENTION.

The fifth annual convention of the Northwest Light and Power Association was held at Portland, Oregon, September 11, 12 and 13, 1912. The following program was announced:

Wednesday, September 11th.

Address of Welcome—Edgar Piper, President Portland Commercial Club.
Response by the President.
President's Annual Address.
Report of Secretary and Treasurer.
Report of Auditing Committee.
Reports of Committees.

"Is Residence Lighting Profitable?"

Editor—
O. V. Snyder, Seattle, Wash.

Associate Editors—
M. C. Osborn, Spokane, Wash.
H. D. Gates, Hillsboro, Oregon.
H. R. Kingman, North Yakima, Wash.
Stacy Hamilton, Portland, Oregon.

"Justification of a Rate."

Editor—
D. C. Barnes, Everett, Wash.

Associate Editors—
A. S. Grenier, Portland, Oregon.
Leslie Coffin, Bellingham, Wash.
C. E. Groesbeck, Portland, Oregon.

Thursday, September 12th.

"Uniform Classification of Accounts for Electric Light and Power Companies."
F. Shaw Baker, Assistant Treasurer Butte Electric and Power Company.

"Intangible Values of Electric Lighting and Power Properties."
William J. Hagenah, Public Utility Statistician. (Former member of Wisconsin Public Service Commission.)

"Reciprocal Duties of the Public Service Corporations and the Public."
Colonel C. E. S. Wood, of the Multnomah County Bar.

"Public Service Commissions."
Franklin T. Griffith, Portland, Oregon.

"Scientific Operation of a Central Station."

Editor—
O. B. Coldwell, Portland, Oregon.

Associate Editors—
D. F. McGee, Portland, Oregon.
George E. Quinan, Seattle, Wash.
Victor Greisser, Spokane, Wash.

Friday, September 13th.

"Relative Value of the Commercial Department in Central Station Service."

Editor—
A. F. Douglass, Portland, Oregon.

Associate Editors—
M. D. Spencer, Everett, Wash.
A. C. McMicken, Portland, Oregon.
H. S. Wells, Portland, Oregon.
Lewis A. Lewis, Spokane, Wash.

"Use of Electric Power for Irrigation and Other Rural Purposes."

Editor—
George C. Arrowsmith, North Yakima, Wash.

Associate Editor
Arthur Gunn, Wenatchee, Wash.

Executive Session—Election of Officers.

President Davidson, in his annual address, reviewed the excellent work of the association during the past year and suggested ideas for future action, not only in increasing the membership, but also in perfecting conditions so as to actually promote a closer relationship with the public. Particular stress was laid on the desirability of securing members among university and college authorities and thus promote a proper understanding of corporation methods among the rising generation.

The routine duties of the association officials were discussed and proposals made for their more efficient accomplishment, including a news service, statistical information and circular letters to members.

The work of the several appointive committees was discussed and a tribute of appreciation paid to their work and to that of the secretary.

Some little attention was given to the good effects of the affiliation with the National Electric Light Association and the Seattle convention. The subject of resuscitation from electric shock and means for giving a wider knowledge of its methods was described in detail. Regarding public service commissions the speaker stated:

"The officers of many utility companies view regulation with disapproval, but I feel I voice the sentiments of the majority when I say we are in accord with fair and efficient state regulation. The Public Service Commission of Washington took up its duties on January 1st of this year. In Oregon, the public utility bill was passed by the last legislature, but it has been referred to a vote of the people and is not yet a law. In the coming fall election, it will be voted on, and the concensus of opinion is that it will undoubtedly be passed, which will broaden the powers of the Railroad Commission, the law being retroactive to January 1st, 1911. This being true, we will then have state regulation in both Oregon and Washington."

President Davidson concluded his address with a strong plea for fair and above-board dealing with the public and thus create more favorable public relations.

The various other papers, which will be published in future issues of this journal, were thoroughly discussed. Perhaps the most valuable paper of the convention was that of Mr. Wm. J. Hagenah, which will long stand as a classic on the subject of corporation regulation.

The election of officers resulted as follows: President, W. J. Grambs, Seattle; Vice-President for Idaho, J. J. Jennings, Lewiston; Vice-President for Oregon, A. C. McMicken, Portland, Executive Committee, O. B. Coldwell, Portland; Douglas Allmond, Anacortes; Elmer Dover, Tacoma.

While much business was accomplished there was also considerable enjoyment interspersed.

ENTERTAINMENT.

Wednesday, September 11th.

At 8 p. m. the delegates and their families went to The Oaks Amusement Park where special entertainment features were provided. The program was in charge of the Portland section of the Jovians and "High Jinks" was chairman of their committee. There were refreshments for the thirsty and hungry, and dancing for those so inclined.

Thursday, August 12th.

An automobile ride throughout the city was given all visiting ladies. At 8 p. m. a rejuvenation was held by the Portland Jovians.

In this rejuvenation thirty-five candidates became Sons of Jove. Those receiving the most marked honors were C. J. Franklin, A. C. McMicken, Mr. Wessinger, E. W. Bonness, Max Wood and Walter Ayden. The rejuvenation was preceded by a parade through the Multnomah Hotel headed by "the hungry seven" and was followed by a joviation when a number of unworthy rejuvenated satellites received their just deserts from Lucifer, admirably impersonated by E. A. West. The degree team was as follows:

Jupiter, C. P. Osborn
Neptune, L. R. Elder
Vulcan, N. W. Brockett
Pluto, E. A. Whitney
Mars, W. H. Wall
Hercules, C. R. Dederick
Apollo, Carl Wernicke
Mercury, Geo. Sailor
Imps, Wells, Parker, Ryan, Barker, Fehr

Friday, September 13th.

At 8 p. m. the annual banquet of the Association was held in the banquet hall of the Multnomah Hotel. While the banquet was in session the ladies of the convention were the guests of the Association at the Orpheum Theatre.

The log sheet at "the Multnomah substation" showed the diet to be made up of frequency changers, submarine insulation, boiler compound, transit oil, and various other unusual concoctions. B. S. Josselyn acted as plant superintendent and C. C. Chapman, W. W. Cotton, Wm. J. Hagenah and W. O. Johnson as substation attendants.

Saturday September 14th.

All delegates and their families were the guests of the Portland companies at an old fashioned picnic at Estacada Park. The River Mill and Cazadera plants of the Portland Railway, Light & Power Company are located here, and an opportunity was given to all to inspect these plants.

The Central Station men crossed bats with the Supply Companies.

The registration list, exclusive of a large number of representatives from the Portland Railway, Light & Power Company and the Pacific Power & Light Company, was as follows:

Douglas Allmond, Anacortes Water Co.
Geo. Arrowsmith, Pac. P. & L. Co.
B. P. Bailey, Pac. P. & L. Co.
G. N. Barker, G. E. Co.
W. N. Birney, Westinghouse Co.
H. L. Bleecker, W. W. P. Co.
A. M. Boykin, Wash.-Ore. Cor.
C. L. Brown, Kenton Trac. Co.
E. W. Bonness, N. W. Elec. Co.
N. W. Brockett, P. S. T. L. & P. Co.
H. V. Carter, Pacific States Elec. Co.
C. E. Canada, G. E. Co.
D. E. Campbell, Vote Berger Co.
M. G. Carhart, Gt. West. Pr. Co.
C. E. Condit, N. W. Elec. Co.
A. M. Chitp, Everett R. L. &. W. Co.
O. O. Colderhead, Wash. Public Service Commission.
O. B. Coldwell, P. R. L. &. P. Co.
W. H. Crawford, C. C. Moore Co.
R. E. Davis, Pac. P. & L. Co.
J. E. Davidson, Pac. P. & L. Co.
R. F. Dean, Hood River Gas & Electric Co.
A. H. Douglas, H. M. Byllesby Co.
H. B. Dunn, P. S. T. L. & P. Co.
H. E. Duren, G. E. Co.
W. C. Earle, Oregon Railway Commission.
P. J. Edwards, Yamhill Electric Co.
H. T. Edgar, P. S. T. L. & P. Co.
S. S. Einstein, Spec Device Co.
L. R. Elden, G. E. Co.
A. A. Elrick, West. Elec. Co.
Eugene Enloe, Big Bend Lt. & Pr. Co.
L. B. Faulkner, Olympia Lt. & P. Co.
J. D. Fellows, Harney Valley L. & P. Co.
L. G. Fehr, Westinghouse Co.
G. E. Gay, Pac. P. & L. Co.
O. B. Gates, Prairie L. & W. Co.
W. J. Grambs, P. S. T. L. & P. Co.
H. L. Gray, Wash. Public Service Commission.
V. H. Greisser, W. W. P. Co.
J. S. Gror, N. W. Elec. Co.
S. B. Gregory, Arrow Elec. Co.
L. R. Grant, P. S. T. L. & P. Co.
Arthur Gunn, Wenatchee Valley Gas & Elec. Co.
A. H. Halloran, Journal of Electricity.
H. A. Hart, Olympia Lt. & Pr. Co.
L. V. Harper, Chelan W. P. Co.
W. J. Hagenah, Chicago.
A. S. Hall, Hood River Gas & Elec. Co.
H. H. Hall, H. W. Johns-Manville Co.
O. B. Helt, G. E. Co.
C. R. Hemerick, Fobes Supply Co.
G. H. Humphries, P. P. & L. Co.
Doug. Huntington, P. S. T. L. & P. Co.
W. L. Ingalk, Pac. States Electric Co.
A. T. Irwin, Idaho-Wash. L. & P. Co.
J. J. Jennings, Lewiston-Clarkston Imp. Co.
R. F. Jennings, Oregon Pr. Co.
W. O. Johnson, Consult. Engr., Portland.
I. Jump, Westinghouse Co.
B. L. Karns, Westinghouse Co.
L. D. Kelsey, Aberdeen.
J. B. Kilmore, Pac. P. & L. Co.
J. M. Kincaid, Key City L. & P. Co.
F. M. Kolloch, Westinghouse Co.
G. A. Krimler, G. E. Co.
G. A. Lee, Wash. Public Service Commission.
W. R. Lyall, D. & W. Fuse Co.
A. M. Mechlein, Wash. Public Service Commission.
G. A. Martin, Yamhill Elec. Co.
S. McComber, City Engr. Centralia.
McKissick, N. W. L. & W. Co.
A. S. Moody, G. E. Co.
R. F. Monges, G. E. Co.
H. I. Miller, Pittsburg Meter Co.
L. A. McArthur, Pac. P. & L. Co.
D. F. McGee, Pac. P. & L. Co.
A. C. McMicken, P. R. L. & P. Co.
O. B. McCriax, Wenatchee Valley Gas & Elec. Co.
H. E. Norton, Oregon Pr. Co.
G. L. Nevins, Pac. P. & L. Co.
F. D. Nims, West. Canada Co.
A. V. Olsen, Folles Supply Co.
B. Olsen, G. E. Co.
M. C. Osborne, W. W. P. Co.
A. A. Parker, G. E. Co.
L. C. Parks, Oregon Pr. Co.
H. E. Plank, G. E. Co.
W. D. Pearlee, G. E. Co.
A. E. Ransome, Olympia Pr. Co.
J. H. Ralston, Ralston Elec. Supply Co.
M. Ray, Hood River Gas & Elec. Co.
J. A. Rolph, Hermiston Lt. & Pr. Co.
E. G. Robinson, Jim Creek W. L. & P.
A. J. Ruel, North Idaho & Montana Power Co.
G. R. Sailor, Westinghouse Co.
W. T. Sachtliken, Bremerton Charleston Lt. & Pr. Co.
F. M. Shields, Idaho-Wash. Pr. Co.
I. A. Shornio, G. E. Co.
H. R. Simonds, W. W. P. Co.
W. Spalding, Tillamook Elec. Lt. & Fuel Co.
H. C. Stoddard, Calif.-Oregon Pr. Co.
M. D. Spencer, Everett Gas Co.
C. T. Terrell, P. S. T. L. & P. Co.
F. C. Todt, Pac. States E. Co.
J. R. Townsend, E. E.
C. M. Wright, Peerless Lamp Wks.
H. P. Weaver, Inspect. Bur.
C. T. Wernicke, Westinghouse Co.
J. L. White, Dallas, Ore. Pr. Co.
E. L. Whitney, G. E. Co.
L. M. Whittington, Westinghouse Co.
L. A. Wallen, P. S. T. L. & P. Co.
H. S. Wells, Pac. P. & L. Co.
H. B. Zimmerman Grays Harbor P. & Lt. Co.
C. B. Young, Pac. P. & L. Co.

CONVENIENT CONVERSION TABLE FOR FROST WORK.

BY A. G. McADIE.

Orchard heaters, evaporators and frost protectors of various forms have come into such widespread use that a convenient table for the quick conversion of heat units into power units, and vice versa, seems to be much needed.

It may be pointed out that the British thermal unit, as defined most recently by Marks & Davis in their steam tables, is 1/180 of the quantity of heat required to raise one pound of water from 32° F. to 212° F. This is the unit most frequently used by engineers in this country and Great Britain, although it is desirable that the old English units and the Fahrenheit scale be used as little as possible. A British thermal unit is equal to 0.252 calorie and also equal to 777.5 foot-pounds. One therm will raise the temperature of 1 gram of water 1° C.; 1,000 therms equal 1 calorie, equal to 3,968 British thermal units.

In problems connected with the heat of water, it should be remembered that the total heat is the latent heat plus the sensible heat. The total heat required to evaporate water at a given temperature is $1{,}059.7 + 0.428\ T$, where T is given temperature. This holds for temperatures between 32° F. and 212° F.

In changing to steam at 212° F., a pound of water at 212° F. absorbs 970.4 British thermal units and the total heat is therefore 1,150.4 British thermal units. This is starting from a temperature of 32° F. A pound of ice at 32° requires 142.4 British thermal units to change into water at 32° F.

The latent heat of aqueous vapor may be found from the following formula:

$$L_a = 1{,}091.7 - 0.572\ t_a$$

Where L_a = latent heat

t_a = temperature of water.

For convenience in frost work the following may be used:

1 kilowatt-hour = 3,412.66 B.t.u.
1 H.P. = 746.3 watts.
1 H.P.-hour = 2,544.6 B.t.u.
1 B.t.u. = 777.5 foot-pounds.
1 B.t.u. = 0.252 calories.
1 calorie = 1,000 therms.
1 calorie = 3.968 B.t.u.
1 calorie per kilogram = 1.8 B.t.u. per pound.
1 pound of air at 32° F. occupies about 12.4 cubic feet.
1 pound of water at 212° F. occupies about 0.0160 cubic feet.
1 pound of steam at 212° F. occupies 26.79 cubic feet.
1 pound of water at 212° F. occupies 180.00 B.t.u.
1 pound of steam at 212° F. contains 1,150.4 B.t.u.
1 pound of ice requires 148.8 B.t.u. to change to water.
1 cubic foot of water at 212° F. weighs 59.84 pounds.
1 cubic foot of water at 62° F. weighs 62.2786 pounds.
1 cubic foot of steam at 212° F. weighs .03732 pound.
1 cubic foot of dry air at 0° C. weighs 1,293.05 grams.
1 cubic meter of dry air at 0° C. weighs 1,293.05 grams.
Specific heat of water, 1,000, (as an average between 32° F. and 212° F.).
Specific heat of ice, 0.489.
Specific heat of water vapor, 0.453 at atmospheric temperatures.
Specific heat of air, 0.241.

Values given above are laboratory values, obtained by using distilled water. Ordinary drinking water is heavier than distilled water, because of matter in solution. Salt water is also heavier. It may also be remarked that the temperature of the freezing point in ordinary use, i.e., 32° F., or 0° C., may not hold for the freezing of water in plant life. W. N. Shaw instances one plant where the freezing point is apparently 21° F. In other words, the change of water from the liquid to the solid state under natural conditions is somewhat different from the change as studied in a laboratory.

Note.—Some of the values given above differ slightly from those found in textbooks, but it is believed they are the most recent.

THE LATENT POSSIBILITIES OF THE ELECTRICAL DEVELOPMENT LEAGUE.[1]

BY W. W. BRIGGS.

The president of the League asked me on Thursday of last week to prepare a paper on some subject for this meeting. I must crave your indulgence, however, in this presentation of the large subject selected, as I have barely skimmed the field, owing to the limited time afforded in its preparation.

I feel that the time has arrived when the possible scope of this organization might properly be discussed. That an organization of this kind would be of service to the electric industry in and about the city in which we live, is indicated by the rapid growth of this one.

Probably owing to this growth, collective attention has not been given to the possibilities of general good to the electric industry that are latent in such an organization, and it is further possible that, if our ideas were directed to the channels where this organization could stand sponsor for the different trade and social organizations of the electrical industry, a greater general benefit might be secured.

We all remember the ancient fable of Aesop and the bundle of fagots. We, in a sense, have a similar condition in our local electrical industry.

The central stations have their problems and the manufacturer, dealer, jobber and contractor each have theirs, but the welfare of any or all of them are more or less corelated.

Thus, any condition that develops, adverse to the interest of the central station industry, will be reflected along the line and felt by all other allied interests. Ill-considered, adverse legislation, effecting the securities or management of public service corporations, tends to restrict the development, which condition is at once reflected in a general trade depression—the manufacturer finds his apparatus orders falling off—the contractor finds little or no work to do where extensions of service are not under way, and the jobber and dealer finds their business lessened in consequence.

Unfair and arbitrary rulings and inspection by the city or underwriters' authorities, unduly harrass the contractor, involving him in unnecessary and unforseen costs, placing his industry on an unstable basis, reflected in reduction of working surplus and restriction of credit. The indirect effect of costs and delays incidentally are again felt by the dealer and jobber in the unstable credit situation, obsolescence of stocks, etc.

It often occurs that the authority under city or underwriters' inspection, is placed in the hands of individuals incapable of clear interpretation of the regulations and from whose ruling, there is no appeal.

There are many regulations incorporated in such rules, that fail of their purpose of safe-guarding the consumer and reducing the fire hazard, and which regulations would appear to have been incorporated for the principal purpose of favoring some patented article.

Let us now consider the possible remedy for this character of ills.

We must first, firmly fix in our minds that this organization is formed for the principal purpose of advancing the electrical industry and that such a result cannot be accomplished by anything but by a policy of standing firmly on a plank of fair and equitable treatment to all with whom we come in contact. We should have no time for anything that smacks of trick or device, but support only such policies as make for advanced conditions in every sense of the word.

Take for instance, the case as above mentioned, of ill-considered and inadequate legislation on the part of a governing body, such as would unjustly affect a central station. The presentation of a protest by that central station, as an individual company, would probably have limited effect, owing to the feeling that this one station had an "ax to grind." However, should that station be a member of an organization such as ours, and have discussed the condition with our committee, and finally, through that committee, has presented the matter to this body and received its unqualified endorsement, then, when presented to a governing body, backed by the weight of opinion of the electrical industry as represented by our organization, believe me, they will be heard with a degree of interest not possible through other means.

Consider also the possibility of the inspection bureau, having an inspector improperly equipped either in technical knowledge or temperament to properly administer his duties. A complaint, no matter how well founded, emanating from a contractor or a number of contractors, would have comparatively small weight, as the complainants would be the parties directly interested. Could this matter have been referred to our organization and have received its calm and judicial study, a protest from such a body would carry much weight.

In this field, then, there is a possibility of great good being accomplished by this organization, and in consequence, added opportunities for the develcpment and advancement of our business, due to our solidified presentation of such matters.

I would suggest that consideration be given to possibilities of development under this head, and that it be considered the duty of our grievance committee to take up, study and report on such matters as might be brought to their attention from time to time by our membership.

It is possible that the name of this committee could properly be changed to that of public policy committee, with duties similiar to that of tht same committee of the National Electric Ligh Association, but confining their efforts to our local situation.

There are many other things that could be developed by our initiative in this line of endeavor, such as the formulation and advocacy of amplified wiring regulations, to care for the growing appliance and electric sign business; the preparation of papers issued under authority of this League, which would interest architects, engineers and others, and point out to them the desirability of caring for appliance and sign loads when laying out building and residence wiring.

As I once said to you in an informal talk, let us disabuse our minds of the impression that we have a "God Given Right" to be in the electrical business.

In these days no one can succeed by hanging out a sign and sitting back complacently and feel that he must thrive because of his sign.

This applies to every interest here represented, and one of the greatest things that this League can accomplish, is to so stimulate its membership that they will put behind them, old, worn-out traditions and bring to bear on collective and individual interests, the necessity of being up and doing in creating new business.

The jobber, dealer and contractor have no justified complaint to make when a central station enters the appliance field and apparently takes business from them, when they (the jobbers, dealers and contractors) are satisfied to sit back and take care of such business as offers without an effort to stimulate the demand, or when they take no pains to see that appliances of proper voltage, etc., are supplied. The central station wants to sell the energy, and if those to whom, in the natural course of events, the appliance business belongs, will not fill their function, the central station is justified in so doing.

Similarly, the consulting engineers should not complain if the manufacturer and his engineers encroach on their field, when they, themselves, will not properly fill it, and apparatus and energy sales lie dormant, awaiting some one with initiative to inspire their uses.

Ethics to the contrary, the time has passed when any field of endeavor remains closed to other activities, when one or more interests must suffer because of the failure of a

[1]Presented before Electrical Development League, San Francisco, Sept. 10, 1912.

branch of the industry to properly fill the space allotted to it in the original scheme of things.

I am impressed with the fact that a large part of our energies (and this condition is not necessarily confined to the electrical industry) are expended in endeavoring to take from each other, business already created, rather than looking afield and seeking where our activities might better be expended in the development of new applications.

In this organization we can accomplish much in this desired direction, by collective thinking. To be sure, the interests represented here are largely competitive—but what of that—a stimulus given by any one's initiative will bring him a just reward, and still the business, as a whole, will have been improved and everyone ultimately secure his relative share of the development.

As a case in point, I might quote from a personal experience:

I placed in effect with the local office of the interest that I have the pleasure to serve, some policies, which involved a considerable expense for the purpose of developing a certain demand for apparatus and through our efforts and reports, a number of prospective customers were interested. It so happened that we did not secure a single contract from the first five negotiations handled, but our competitors did, and also the central stations.

New business was created, although my men were temporarily discouraged. But, some of the central stations recognized the pioneer work that had been done and awarded us business that we had not previously enjoyed, which compensated us in a very large measure.

There is a vast field for development of new business along electrical lines in and around these communities, in which the membership of this organization are interested, and I feel that through an interchange of ideas by papers presented at these meetings—by a mutual understanding of each others' problems, the initiative necessary to develop new business, may be stimulated.

Possibly it might be considered as one of the duties of your "Ways and Means" committee to study such possibilities, and from time to time submit reports that would point out to the membership, matters for consideration, wherein concerted action on the league's part, would stimulate business.

Again, let us emphasize that we all owe a duty to the public and our customers and consumers, to safe-guard their interests.

The contractor who would, for a temporary profit, advocate the use of an improper or antiquated device or wiring system, the dealer, jobber or manufacturer who would, to clear his stock or for other reasons, furnish the customer with improper lamps or other devices, or the central station who stoops to misrepresentation to secure a contract, have no place in this organization and are not entitled to its support.

In the disposition of our commodities, whether they be energy, appliances or machinery, let us not advocate taking the path of least resistance to secure contracts or orders, but rather study our customers' requirements and give them the benefit of our knowledge and experience, to the end that, from our activities in our chosen field of endeavor they will secure a maximum of service at a minimum of cost.

I would further strongly advocate that this league be considered (for the local district) as the parent commercial organization of those interested in the electrical industry. We have diversified interests in our midst, who, of necessity, have many intimate problems to discuss and so vast are these that they could not receive proper consideration at our meetings, and for that reason have their separate organizations. However, a great need exists for a strong central body where every local electrical interest can join and I believe we have this organization in the Electrical Development League.

Might we not logically consider that for the local electrical industry, the league be considered the central body, offshooting from which we would have such organizations as—

The Energy Club, represented by the central stations and power salesmen and those interested in the disposition of energy.

The Jovians, a national organization, might be considered as the right bower of the local Electrical Development League and the social branch of its activities.

The jobbers and contractors, The American Institute of Electrical Engineers, The National Electric Light Association, are all national bodies and are thoroughly organized. For our interests they can, with propriety, co-operate with this league in fostering the industry locally and assist us to put up a substantial and solidified presentation of a cause, where such need exists.

It is further possible that, as the league develops and becomes stronger, it might affiliate with the local chamber of commerce and thus secure the potential benefits of that still larger organization.

To secure the desired result in connection with an organization of this character, requires the unqualified support and endorsement of its activities by its entire membership.

You have had given to you an example of the capacity of this league, in entertaining visiting guests interested in the electrical business, such as the entertainment afforded travelers through this city on their way to the National Electric Light Association Convention. This is another function where the league serves the purpose of uniting all of the electrical interests in one compact organization to assist in the entertainment of electrical people who, from time to time, may visit us, creating a most favorable impression throughout the country and reflecting credit on our city and industry.

I feel that I have but briefly sketched a few of the possibilities of the Development League, but that perhaps one or two of the ideas here expressed, may be of service in molding your opinions as to the benefits that may accrue to all concerned.

ELECTRICAL CONTRACTORS' NOTES.

The National Electric Company has obtained the contract for wiring the Patrick Henry School.

The wiring of Nathan, Dohrman & Co.'s warehouse on Bluxome street, south of Fifth, was awarded the Decker Electric Company for the sum of $1673.

Bids are being taken for the Insurance Exchange Building at California and Leidesdorf streets. The electric work will run close to $15,000. Willis Polk Company are the architects.

The Butte Engineering & Electric Company was awarded the contract for the completion of the electrical work on the San Francisco City and County Hospital for the sum of $11,800.

A luncheon was given Thursday, September 12 by the secretary of the Electrical Contractors to Engineer Guy Bayley of the Panama-Pacific Exposition Company. The contractors listened very attentively to Mr. Bayley's version of how the engineering work will be handled. Those present were Guy Bayley, Frank Watts, C. F. Butte, L. C. Ames, Nelson Hope and W. S. Hanbridge.

The John G. Sutton Company was awarded the wiring contract for Shreve's new factory, on the southwest corner of Bryant and Zoe streets. The contract price was $9136. A feature of this factory worth mentioning is the fact that each machine has a separate motor and that all machines are set on separate piers, built up from the foundation and independent of the building, so as to do away with all vibration.

NEWS NOTES

INCORPORATIONS.

SAN FRANCISCO, CAL.—Presto Electric Company, $500,000, shares $10 each, subscribed $50, by S. A. Fairchild, M. Meagher, E. Barats, S. J. Brun and J. W. Schmitz.

ARTESIA, N. M.—The Artesia Light & Power Company, whose stock was purchased by John C. Keys of Oklahoma City, is being succeeded by the Pecos Valley Gas & Electric Company, which is being incorporated by Mr. Keyes. The new company has power to make and dispose of gas and electricity, sink wells, install pumping plants and may construct and operate an electric railway.

RENO, NEV.—It has developed that the incorporators of the Sierra Telephone & Telegraph Company, which is seeking a franchise for a telephone line in this city, are T. F. Dunaway, vice-president of the Nevada-California-Oregon road; H. G. Comstock, a real estate man, and E. F. Brown, a local attorney. It is also stated that a Portland capitalist is behind this move and that it is to be part of a new telephone system in the Western States.

TULARE, CAL.—Revised articles of incorporation have been filed by the Big Four Railroad, in view of the ratification of the proposed enterprise by the officials of the Porterville Chamber of Commerce, and the determination of the directors to proceed at once with the construction of the railroad to the citrus district through the Poplar dairy country. The capital stock of the new company appears at $500,000 in the revised articles. Four directors have been added to the board, the new ones being W. F. Ingerson, a Visalia merchant; C. A. Whitmore, a Visalia newspaper owner; H. W. Hannaford, a Tulare district property owner, and J. W. L. Marsna, a Tulare district rancher.

ILLUMINATION.

LOS ANGELES, CAL.—Plans are under way for placing specially designed electroliers through the Country Club park.

GLENDALE, CAL.—The lighting system of this city is to be extended immediately into Verdugo canyon, recently annexed to the city.

RIVERSIDE, CAL.—There were no bidders for the installation of an ornamental lighting system and the city officials figured on the job and awarded the contract to the city.

LOS ANGELES, CAL.—Fire in the showroom of the Southern California Edison Company, at 55 E. Colorado street, Pasadena, did damage estimated at $10,000 in that establishment.

SACRAMENTO, CAL.—The construction of the new Pacific Gas & Electric Company's building on the southeast corner of Eleventh and K streets will be started soon. The building will be four stories high, steel frame with pressed brick and terra cotta exterior.

MARYSVILLE, CAL.—The Oro Light & Power Company has filed with the Supervisors of Yuba County an application for a 50-year franchise to operate its business in this county. It asks to be permitted to erect poles on the highways and stretch wires in the streets and alleys of the city.

SAN FRANCISCO, CAL.—The postponed hearing of the application of the Pacific Gas & Electric Company to the Railroad Commission for permission to issue $5,000,000 of its general and refunding mortgage bonds for the development of its power and irrigation systems on Bear and Yuba Rivers, began last week before Commissioner J. M. Eshleman. At the close of the hearing, President Eshleman said that he would decide the matter promptly. The most interesting testimony from a financial standpoint, was John A. Britton's explanation of the care exercised by the Bankers' Trust Company of New York, which is advancing the needed funds for the construction work, in subjecting all items to careful scrutiny, Mr. Britton said: "First, every item and voucher are carefully examined by our own officials, checked, and assigned to capital account or operating account. Then a representative of the Bankers Trust goes over them. Finally, an independent firm of accountants checks every item and examines every voucher. Not until all this has been done do we receive the money." Assistant General Manager J. H. Wise testified that the power to be developed with the funds to be secured by the sale of these bonds would equal 40,000 kw., of which 20,000 kw. would be utilized in supplying Folsom and the other 20,000 would take care of the growth this year and next. In the course of the hearing it was brought out that it is the intention of the company in the near future to apply for permission to issue another $7,000,000 in bonds to finance the construction of irrigation and power works along the Bear River and at Lake Spaulding. Representatives of the company said that its bonds in the past had been sold to J. P. Morgan & Company of New York.

TRANSMISSION.

PLACERVILLE, CAL.—The Western States Gas & Electric Company is soon to begin work on a power line to Camino.

MARTINEZ, CAL.—The application of the Great Western Power Company for a blanket franchise for power lines through the county was rejected by the board.

VENTURA, CAL.—The Ojai Power Company has made application for a franchise, granting the right to construct an electric light and power system along the public highways of Ventura County. Sealed bids will be received up to October 3.

TELEPHONE AND TELEGRAPH.

SHOSHONE, IDAHO.—A force of surveyors employed by the Mountain States Telegraph & Telephone Company is running a line from Mountain Home to Shoshone.

DOUGLAS, ARIZ.—The telephone system of this city will be entirely reorganized within the very near future. The plan of the company is to use conduits to carry wires underground.

SHOEMAKER, N. M.—Work on the Ranchers' Telephone Company's lines is being rapidly pushed forward. They expect to soon connect with the standard lines, at Wagon Mound and Las Vegas.

WINNEMUCCA, NEV.—The Golconda Telephone & Power Company has applied for a franchise to erect poles and string wire thereon for a new telephone line from Winnemucca to National, via Paradise Valley.

SAN RAFAEL, CAL.—The Marconi Wireless Telegraph Company of America with offices in the Phelan Building, San Francisco, is closing a $25,000 deal in a ranch near Bolinas for a site for a wireless station. It is the intention of the company to expend about $150,000 on the plant.

WINSLOW, ARIZ.—Word has been received here that the Mountain States Telephone & Telegraph Company, which recently took over the holdings of the Overland Telephone & Telegraph Company, of this State, has sold part of its holdings to F. W. Nelson of St. Johns and Messrs. W. B. Woods and Lloyd C. Henning of Holbrook.

SEATTLE, WASH.—Notice has been served on the Pacific Telephone & Telegraph Company by the superintendent of Public Utilities of Seattle that the physical assets, conduits, etc., of the Independent Telephone Company, which was

recently acquired by the Pacific Company, must be immediately removed from the streets. The franshises of the Independent Company was repealed in July. An ordinance has been adopted which provides that the city shall take charge of all conduits of the old company occupying the streets after a specified date. If the city takes this property it is the intention to use it as a foundation for a municipal telegraph system.

LOS ANGELES, CAL.—Interchange of telephone service between the two companies operating in this city, or, in lieu of that, the consolidation of both companies, was recommended in a report of the utilities committee of the Los Angeles Realty Board, read before the members of the board at their last weekly luncheon. The board as a whole, however, refused to take any action until the members shall have had the opportunity of hearing the matter argued at more length at a later meeting. During the discussion it was pointed out by opponents to the consolidation plan, that as a result of the dual service it is now possible to get two main lines to an office for the same price that was formerly paid for one line before the Home Company came into the field, and a fear was expressed that a change would bring about lack of competition, poor service and higher rates.

SAN FRANCISCO, CAL.—A conference of officials of the Western Union Telephone Company, Pacific division, embracing California, Oregon, Washington, Nevada, Arizona and British Columbia, was held recently in San Francisco. This was one of the regular meetings frequently held by the officials of the company for the purpose of considering existing business conditions and prospects in order that extensions and improvements of the facilities and service may be arranged for accordingly. Those in attendance were Division Commercial Superintendent H. F. Dodge, San Francisco; Division Commercial Superintendent A. H. May of San Francisco, E. Boenning of Seattle, and H. McPhee of Los Angeles; Division Traffic Superintendents H. C. Chase of San Francisco, H. J. Jeffs of San Francisco, G. D. Hood of Seattle and R. H. Fuller of Los Angeles.

TRANSPORTATION.

TULARE, CAL.—A contract has been let by officials of the Big Four Electric to Hahn & Son of San Francisco for the grading of the line from Tulare to Visalia, and from this point to Porterville, a total distance of 41 miles. The contract price is $30,000.

LONG BEACH, CAL.—An ordinance has been presented to the City Council by the Board of Public Works authorizing that body to enter into a contract with the Pacific Electric to construct a trackage connecting the municipal tracks with the Salt Lake Railroad, which will give all railroads entering the city connection with the municipal docks.

SAN FRANCISCO, CAL.—The State Railroad Commission has granted the petition of Patrick Calhoun and his associates of the United Railroads Company to issue $300,000 of trunk equipment notes as part payment for 65 new cars they are to have built in the East for use in this city. The total cost of the new rolling stock will be $365,000, the company paying $65,000 in cash and the balance in the notes just authorized. The commission takes this favorable action with the understanding that Calhoun and his railroad officials will confer with a committee of the Supervisors about a design for the new cars.

WOODLAND, CAL.—The final stages of the survey of the line of the Sacramento Valley Railroad Company will be started this week from Woodland, the only strip of unsurveyed territory now being between Woodland and Denverton. A large force of men will be put to work under the direction of Melville Dozier, of the Dozier Construction Company. At Denverton the line will join the Oakland and Antioch Railroad, over whose lines an agreement gives the Sacramento Valley the right to run its trains. It is expected that the survey to Denverton will be completed within 30 days, the sale of necessary stock within six months, and that the road will be in actual operation January 1, 1915. Sacramento offices of the company have been opened in the Forum building in the charge of Dumas & Brewer.

SAN JOSE, CAL.—That the Peninsula Railroad Company is anxious to complete its electric line to Alum Rock Park as soon as possible, is indicated by the filing of a suit for the condemnation of a railroad right of way through the lands of James B. Bullitt at the mouth of Alum Rock Conyon. The new line of the Peninsula company to Alum Rock Park was completed by way of Berryessa several months ago as far as the western boundary of Bullitt's place. Construction crews have since been busy between the eastern boundary of the place and Alum Rock Park, leasing an uncompleted link on Bullitt's place. Bullitt is said to have offered the company a free right of way through the rear of his place, but this route is impracticable from an engineering standpoint. The company refused to pay the price he named for a right of way through the front of his place and between his home and the Penitencia Creek, claiming that it was too high.

SAN FRANCISCO, CAL.—The Board of Public Works has awarded the contract for furnishing and installing the electrical conductors and appurtenances for the Geary street road to the John G. Sutton Company for $60,304. This contract calls for the completing and connecting of the electric fittings of the road on the entire route, from the beach to Market and Sansome streets. Other contracts for materials needed for completing the road have been let as follows: Copper wire, John G. Sutton Company, $3187; copper wire bonds, U. S. Steel Products Company, $1510; tie rods and nuts, Payne Bolt Works, $656; tie plates, Eccles & Smith Company, $2304; redwood cross-ties, Julius Heyman Company. A recommendation has been made to the Supervisors that the latter body acquire at once the land necessary for the establishment of a loop termnus for the city line at the ocean beach. The tract needed, states the city engineer, is that bounded by Cabrillo street, the Great Highway, La Playa and a line drawn parallel to Cabrillo street and 200 feet to the north.

SAN FRANCISCO, CAL.—The attitude the State Railroad Commission will take toward public utilities which are seeking permission for their initial financing, was shown in the decision permitting the Big Four Electric Railway Company to sell 100,000 shares of capital stock of the par value of $1 each. The conditions are: First, that the stock should be sold to yield to the company not less than 80 per cent of its par value in cash; second, that no commission shall be paid except on cash actually received from the sale of stock, and that commission should not exceed 20 per cent of the par value of this stock; third, commission shall be paid on stock heretofore sold only in proportion to the amount of cash that has come in; fourth, no expenditures shall be made for road construction until all of the 100,000 shares of stock shall have been sold and not less than $50,000 in cash realized from this stock and placed at the disposal of the company. If the company is unable to realize the sum mentioned, further application may be made to the commission for relief; fifth, the company must report to the commission the sale of stock as it proceeds; sixth, the company must submit for the approval of this commission the form of all contracts for the sale of stock and for construction work involving a cost in excess of $500.

POSITION WANTED— Capable man with civil and mechanical training and experience, desires employment as engineer with manufacturing concern, City preferred. Box 25, Journal of Electricity, Power and Gas, Rialto Bldg., San Francisco.